IAMU
International Association of Maritime Universities

THE NIPPON FOUNDATION

22nd Annual General Assembly

IAMU AGA22

International Association of Maritime Universities

19th - 22st October 2022

BATUMI, GEORGIA

The 22nd Annual General Assembly

The International Association of Maritime Universities (IAMU) Conference Book

Batumi State Maritime Academy

The International Association of
Maritime Universities (IAMU) Conference

Conference Book

Batumi, Georgia

October 2022

22nd Annual General Assembly

IAMU AGA 22

19th – 22st October 2022

Program Editor

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Batumi State Maritime Academy, Georgia

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"A publication of the International Association of Maritime Universities"

Publisher

Batumi State Maritime Academy, Georgia

ISSN: 2706-6738 (Print)

ISSN: 2706-6746 (Electronic)

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Preface

The IAMU Conference (IAMUC) is the part of the 22nd Annual General Assembly (AGA 22) of the International Association of Maritime Universities (IAMU). The IAMUC offers its members the global platform to share their experience and to plan the development of maritime education and related researches.

Travel restrictions, imposed by the COVID-19 pandemic, shifted scheduled hosting of the IAMU AGA at Batumi State Maritime Academy from 2020 to 2022.

The pandemic period is over and IAMUC 22 invites the international experts to disseminate their latest research results. As the hosting university, Batumi State Maritime Academy provides both face-to-face and online participation in the Assembly activities.

"Best Practice: MET and Research for Sustainable Development" is the theme of the AGA 22 IAMUC.

The IAMUC program covers the whole range of Maritime Domain incorporating Environmental, Technology, Economic, Social and Policy sections. The Conference topics deal with Prospective Technologies in Shipping and Offshore Industries, Strengthening Life Long Learning in MET through Innovative Methodologies Application, Enhancing Maritime Safety and Security and Save Our Seas – Environmental Protection Provision.

IAMUC 22 participants are offered to take part in technical workshops and to discuss a wide range of scientific researches with keynote and invited speakers.

"The International Association of Maritime Universities (IAMU) Conference Book" contains information concerning the organization and program of the IAMUC 2022 and the abstracts presented at the IAMUC in Batumi, Georgia on 20th and 21st of October, 2022.

Submission of 94 high-level abstracts from 22 countries and 35 IAMU universities resulted in 37 oral and 10 poster presentations.

The oral presentations at the sessions are followed with the poster presentations held during coffee/tea breaks, although all posters are displayed within the whole conference.

We express our gratitude to the reviewers for their partnership with the authors and contribution in improvement of the quality of submitted papers.

We are very grateful to the International Program Committee, Session Chairs, IAMUC supporting team and BSMA Administrative assistants, who selflessly contributed to the success of the Conference. Also, we are thankful to all the authors who submitted the papers and shared their experience.

Last but not the least, we express our most heartfelt thanks to the IAMU Secretariat for the greatest support and inspiration at each stage of the IAMU AGA implementation.

We hope that experience, shared at IAMUC 22, will promote the future success of Maritime education, training and research.

Associate Professor Nino Kurshubadze

IAMUC 22 Program Editor

Professor Boris Svilicic

IAMUC Chief Program Editor

Theme

Best Practice: MET and Research for Sustainable Development

- Prospective Technologies in Shipping and Offshore Industries
- Strengthening Life Long Learning in MET Through Innovative Methodologies Application
- Enhancing Maritime Safety and Security
- Save Our Seas – Environmental Protection Provision

Local Executive Committee (LEC)

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International Program Committee (IPC)

Program Editor	Nino Kurshubadze Batumi State Maritime Academy, Faculty of Navigation, Georgia
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Session Chairs

Environmental Aspect Session

Chair: Givi Tsitskishvili, Batumi State Maritime Academy, BSMA, Georgia

Technological Aspect Session

Chair: Rom Rabe, Hochschule Wismar, University of Applied Sciences Technology, Business and Design, HSW-UTBD, Germany

Economic Aspect Session

Chair: Minna Keinänen-Toivola, Satakunta University of Applied Sciences, SAMK, Finland

Social Aspect Session

Chair: Angelica Baylon, Maritime Academy of Asia and the Pacific, MAAP, Philippines

Policy Aspect Session

Chair: Zhao Jian, Dalian Maritime University, DMU, China

Co-Chair: Zurab Bezhanovi, Batumi State Maritime Academy, BSMA, Georgia

Student Session

Amr Moneer Ibrahim, Arab Academy for Science, Technology and Maritime Transport, Egypt

Reviewers: Nino Kurshubadze, Abdul Kakhidze, Aleksandre Tsetskhladze, Givi Tsitskishvili, Guladi Tkhilaishvili, Zurab Bejanovi, Tamar Dolidze, Kakhaber Khintibidze (Batumi State Maritime Academy, Georgia);
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Minna Keinänen-Toivola (Satakunta University of Applied Sciences, Finland);
Angelica Baylon (Maritime Academy of Asia and Pacific, Philippines);
Zhao Jian (Dalian Maritime University, China);
Graham Benton (California State University Maritime Academy, USA);
Matthew Rooks (Kobe University, Graduate School of Maritime Sciences, Japan);
Samrat Ghosh (Australian Maritime College, University of Tasmania, Australia)

IAMUC Supporting Team:

Quality Assurance Service, BSMA- Ketevan Diogidze, PhD Student

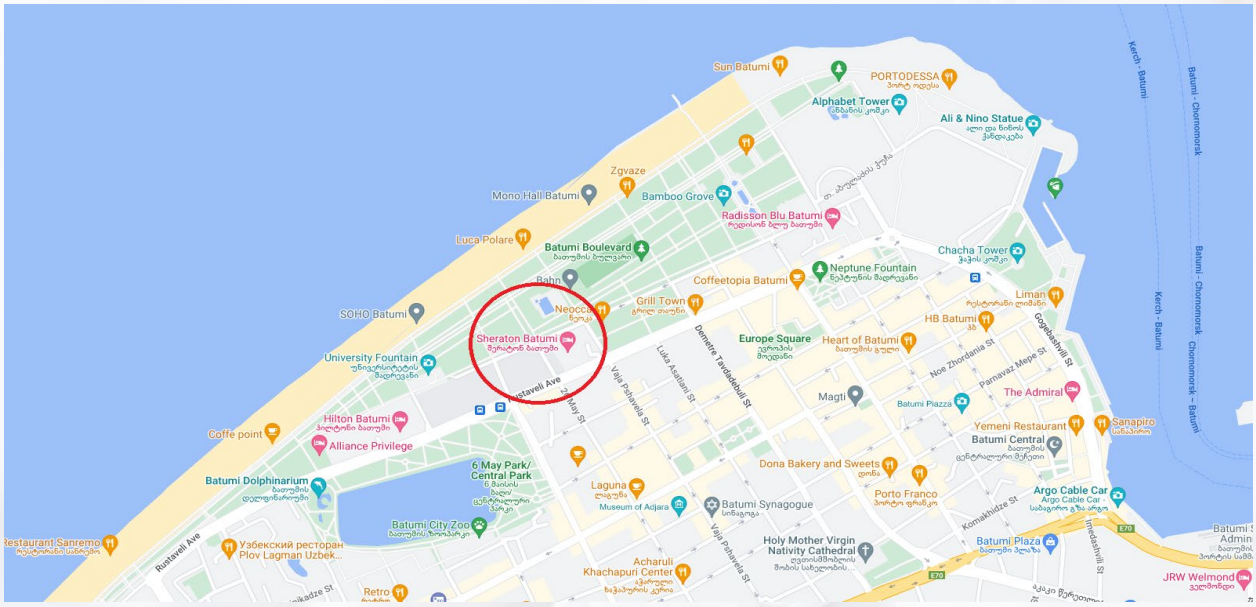
Quality Assurance Service, BSMA – Assistant Prof. Karina Melikjanyan

Venue

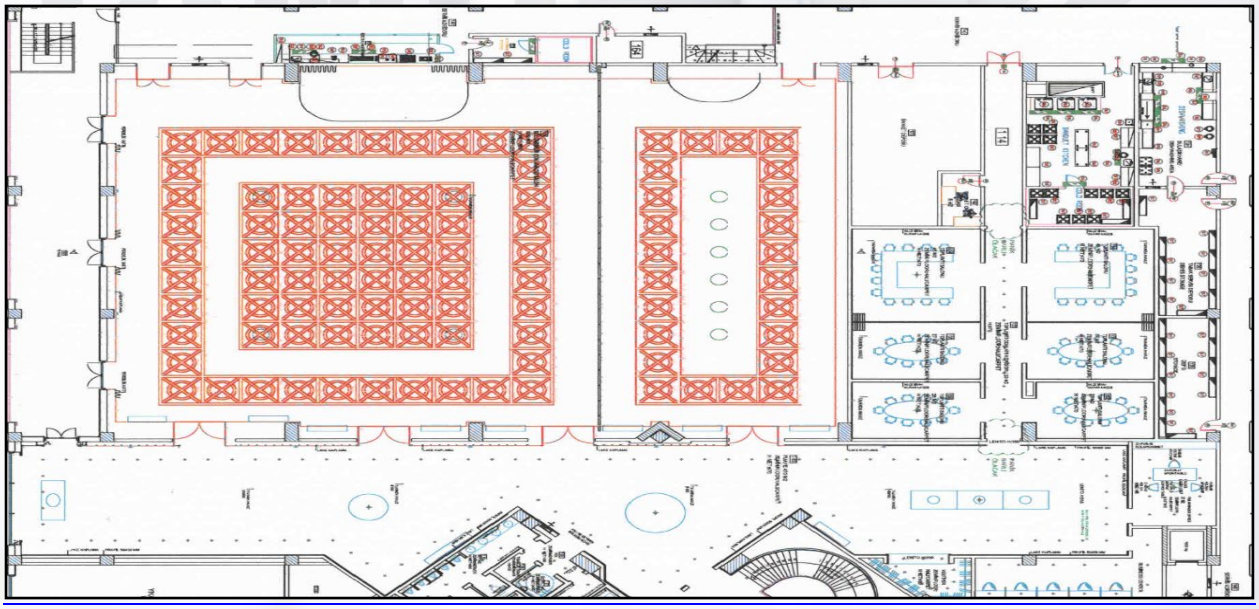
The IAMU Conference is held in the Sheraton Hotel

28 Rustaveli Street, 6000 Batumi, Georgia

Location:



Floor Plan:



Program Overview:

IAMU Conference Thursday, October 20th Location: Sheraton Hotel		
09:00 09:20	**Opening Ceremony of IAMUC**	
Time	**Room # Lilium& Rose**	**Room # Orchid &Mimosa**
	Session: Environmental Aspect *Chair: Prof. Givi Tsitskishvili*	**Session: Social Aspect I *Chair: Prof. Angelica Baylon***
09:20 10:20	**09:20 - Mustafa Nuran, Gamze Arabelen and Nergis Özispa** *"Cost Effect of EU's Carbon Levy by Container Ship Capacities"*	**09:20 - Dr. Nicolas Nause, Russell H. Greenwood** *"Leveraging a visible learning process in higher distance education: a case study in International Maritime Management, M.Sc."*
	09:40 - Valentyna Kudryavtseva, Svitlana Barsuk and Olena Frolova *"Enhancing Green Skills in Maritime English Course"*	**09:40 - Kamil Formela, Krzysztof Wróbel and Mateusz Gil** *"Preliminary results of the identification of entrants' approach towards maritime career"*
	10:00 - Ece Ceylani, İ. Çağrı Kolçak and Elif Bal Beşikçi *"Creating an Industrial Symbiosis with Ship-Generated Waste"*	**10:00 - Ece Ceylani, İ. Çağrı Kolçak and M. Selçuk Solmaz** *"A Ranking of Critical Competencies for Future Seafarers in the Scope of Digital Transformation"*
10:20 10:50	**Coffee Break / Poster Presentations**	
10:50 12:30	**10:50 - Col. Dr.G.Thiruvasagam and Dr.T.Sasilatha, J.Padmapriya** *"Integration of Renewable Energy Sources and Smart Technologies in On-board Ships"*	**10:50 - Dr. R.Vettriselvan and Dr.V.Leela Vinodhan (ONLINE)** *"Promotional Strategies for Gender Equity in Maritime Sector: Maritime Education Institutions"*
	11:10 - Anna Shotadze and Mzia Diasamidze *"Study of Water Treatment Technologies"*	**11:10 - Jana Kegalj and Damir Zec** *"Knowledge representation in MET"*
	11:30-12:30 Session Discussion	**11:30 - Ahmet Lutfi Tunçel and Ozcan Arslan** *"Determination of critical risk factors that prevent in-ship communication during ship operational processes"*
		11:50-12:30 Session Discussion
12:30 13:30	**LUNCH**	
Time	**Room# Lilium& Rose**	**Room# Orchid &Mimosa**
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	13:50 - Dimitar Kanev, Todor Stoilov and Krasimira Stoilova *"Efficient Management of Portfolio Resources"*	**13:50 - Nino Kurshubadze, Tamar Dolidze and Natia Vasadze,** *"The Importance of ESP (Maritime English) in the Maritime Industry for Safety Maintenance On-board and Ashore"*
	14:10 - Joshua Shackman, Marvin Wen Li and Christopher Eastman *"The Predictive Ability of Ocean Freight Rates: Evidence from Japan and South Korea"*	**14:10 - Dr. Malini Shankar and Dr. Balaji Rajoo** *"IMO Session in Classroom: A Case in Experiential Learning"*

	14:30 - Captain Altaf Ur Rehman and Dr. Faisal Al Thobiani *"Maritime Labour Market Dynamics (MLMD) and Futuristic Approach in Developing Skilled Global Maritime Labour (SGML)"*	**14:30 - *Guladi Tkhilaishvili and Manuchar Loria*** *"From Enterprise Resource Planning (ERP) to Universities Resource Planning (URP)"*
		***14:50* - Prof. Dr. Mykhaylo Miyusov, Rector and Capt. Dmytro Zhukov** *"MET in Ukraine in time and after of Russian invasion"*
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15:30 16:30	**Session Discussion**	**Session Discussion**
19:00	**Dinner**	

Friday, October 21st Location: Sheraton Hotel		
Time	**Room # Lilium& Rose**	**Room # Orchid &Mimosa**
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	09:20 - Avtandil Gegenava, Abdul Kakhidze, Tinatin Gegenava, Teimuraz Chokharadze and Joni Babilodze *"Analysis of Hydrometeorological Conditions in the Main Georgian Poti Port, its Impact on the Cargo Turnover and Ways of Solutions"*	**09:20 - Saratkumar C. Narayanan and Gholam Reza Emad** *"The (ir)Relevance of Current Maritime Education and Training in the Transitioning Workplace: An Activity Theory perspective"*
	09:40 - Antonios Andreadakis, Dimitrios Dalaklis, Nikitas Nikitakos and Avtandil Gegenava *"Automated Lifeboat Manifestation Embarkation System (ALMES): Facilitating Evacuation/Manifestation on Passenger and Cruise Vessels"*	**09:40 - Besik Chkhikvadze and Momoko Kitada** *"Mitigating maritime unemployment in Georgia: A Maritime Education and Training perspective"*
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Time	**Room # Lilium& Rose**	**Room # Orchid &Mimosa**
	Session: Technological Aspect ***Chair: Prof. Rom Rabe***	**Session: Policy Aspect** ***Chair: Prof. Zhao Jian*** ***Co-Chair: Prof. Zurab Bezhanovi***
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	"Feasibility study on carbon capture system of LNG-fueled ship-based on comprehensive utilization of heat and cold energy "	
	10:50 - Adi Mas Nizar, Takashi Miwa and Makoto Uchida *"Head-worn Display Utilization in Engine Supervisory Work"*	**10:50 - Jiang Bin, Han Jialin and Cheng Xi (ONLINE)** *"Analysis and Consideration of the Navigation Support Capability of Arctic Shipping Route in China"*
	11:10 - Dr. T.Sasilatha, Col. Dr. G.Thiruvasagam, Dr. D.Lakshmi, R.K. Padmashini and J.K.Vaijayanthimala *"A Study of H-Bridge Multilevel Inverter Driven Marine Propulsion System"*	**11:10 - Zurab Bezhanovi, Tamila Mikeladze, Svetlana Rodinadze, Kristine Zarbazoia and Medea Abashidze** *"Identification and reduction of seafarers' cognitive and behavioral fatigue impacts for effective MET policy development"*
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12:30 13:30	**LUNCH**	
Time	**Room# Lilium& Rose**	
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15:30 16:30	**Session Discussion**	
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- ***Technological Aspect:***
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  - ***Quoc Dat Le, Van Quan Phan*** *- Applying CFD Simulation to Analyse Turbocharger's Impeller of Marine Diesel Engines*
  - ***Maia Tugushi, Kakha Karanadze, Gocha Gogitidze, Firuza Varshanidze, Madona Loria*** *- Optimization of ship electrical power system modes according to reactive power*
  - ***Christiana Atanasova*** *- Digital platforms as factor transforming maritime education and industry*
  - ***Boris Svilicic, Jeric Bacasdoon, Ahmed K. Tawfik, Sam Pecota*** *-Towards a Cyber Secure Shipboard ECDIS*
- ***Economic Aspect:***
  - ***Marieta G. Stefanova, Dimitar Kanev*** *- The impact of process innovations on the maritime transport services in Bulgaria – ONLINE*
  - ***S Dimitrakieva, E Gunes, R Dimitrakiev, C Atanasova*** *- The Role of Digitalization in the Shipbroking Business*
- ***Social Aspect:***
  - ***Junyi Wang, Zeyuan Shen -*** *Analysis on influencing factors of career choice of Chinese students majoring in the navigation based on discrete choice model*
- ***Policy Aspect:***
  - ***Anita Gudelj, Helena Ukić Boljat, Merica Slišković*** *- Identification of Features Associated with University Dropout-a case study of University of Split, Faculty of Maritime Studies*

Technical Instructions

Oral Presentation Guidelines

- Oral presentation slots have 20 minutes.
- Session Chairs will strictly demand time to allow members of the audience to switch sessions between presentations.
- All session rooms are equipped with LED Screens, a computer (MS Windows, MS PowerPoint, and Adobe Acrobat), microphone, remote control, and laser pointer. To avoid software compatibility problems, please embed all fonts in your PPTX file and bring a backup PDF file of your presentation.
- Please bring your presentation on a USB storage device and report to the Session Chair indicated in IAMUC Program 15 minutes before the start of the Session.
- For Online Oral Presentations:
    - Please make sure to have a good stable connection during your live presentation.
    - ***Zoom Webinar*** is the application used for the conference sessions.
    - You will login as a panelist only via the link that has your session's name or number.
    - Please make sure to stay online even after your presentation to participate in the discussion at the end of your session.
    - Please make sure not to share the link (with your session name or number) received on your email as it is intended only for you as a panelist.

Poster Presentation Guidelines

• Posters will be presented during the Poster Sessions indicated in the IAMUC Program. Presenters should be standing next to the poster during the Poster Sessions to answer any question.
• Poster should be printed in size A0 (841 mm x 1189 mm). Please use large fonts (24 or above), avoid using dense text, tell the story in graphics, diagrams, and pictures as much as possible. Poster main ideas should be spelled out in the introduction and conclusions sections. The main point of the work should be crystal clear from spending only a few moments reading these sections.
• Posters will be printed and placed in their allocated place by the Conference organizers well in advance, using X-Banner ready-made rollups. Authors are free to take their posters after the conference closing ceremony at 17:00 on Friday (21st October).
For any help regarding this matter please contact the registration desk.

Name Badge

All attendees must wear the name badge at all times to gain admission to IAMUC.

Mobile Phone

As a courtesy to our presenters and other attendees, please turn off your mobile phones during the sessions.

Session Quick Index

Abstracts Content

IAMU AGA 22

The International Association of Maritime Universities (IAMU)

Conference Book

Session
Environmental Aspect

Preventing pollution of Adriatic Sea: Oil spill trajectory model using Pisces II oil spill scenarios and effects of incident on marine environment using multiple regression approach

Maja Čović[a]

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Keywords: oil spill, marine environment, scenario, PISCES II, the Kaštela Bay

Abstract: Oil spill is the release of a liquid petroleum hydrocarbon such as crude oil, refined petroleum such as gasoline or diesel fuel into the environment due to human activity, which can cause devastating impact to marine ecosystem. According to International Maritime Organization (IMO), oil tankers transport approximately 2900 million tons of crude oil and oil products per year. The quantity of oil spilled annually into oceans exceeds one million metric tons and oil spills have large impact on wildlife and economy as well. This paper presents the simulation of oil spill trajectory on water surface in the Kaštela Bay (in the Adriatic Sea) created by PISCES II simulator. The Kaštela Bay is closed basin with cargo port and terminal for petroleum products distribution. The scenarios determinate processes with oil spill in marine environment: the trajectory of oil spill, chemical changes of oil and persistence of oils in the air, water columns and sediments. The result of several different scenarios are shown in order to give better insight to potential oil spills impact on marine environment in this sensitive location. Furthermore, observing through whole linear multiple regression model (F=2.734; R=0.517; p=0.097) variable *height of wave* has been identified as significant predictor of speed at which oils spread in (b=1.965; p=0.047). In conclusion, this research gives in-depth analysis of incident scenarios in particular sensitive area and gives the correlation between relevant predictors and speed at which oil spreads. Also, it can provide foundation for risk assessment of the incidents and minimize them, as well as to ensure that effective pollution prevention measures are in place.

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INTERREG CRO-ITA: Protecting the Enclosed Parts of the Sea in Adriatic from pollution (PEPSEA), [16] Testing of pilot location and development of risk models and plans for cases of sudden sea pollution - Kaštela Bay

Cost Effect of EU's Carbon Levy by Container Ship Capacities

Mustafa Nuran[a], Gamze Arabelen[b], Nergis Özispa[c]

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Keywords: Carbon Levy, GHG Emissions, Container Ships

Abstract: The increase in global greenhouse gas emissions has revealed the concept of sustainability in transportation and to prevent this increase worldwide, regulations or laws are required. In the literature, the use of fossil fuels is shown as the primary cause of greenhouse gas emissions, and it is stated that the share of the transportation industry in this use is quite high. Although maritime transport is the greenest type of transport, causing the lowest carbon dioxide emissions per unit load carried within the scope of economies of scale, it accounts for 3.3% of global (CO2) carbon dioxide emissions, 2% of nitrogen oxide (NOx) emissions, %11 of sulfur oxide (SOx) emissions and 4% of global greenhouse gas emissions (Tokuşlu ve Burak, 2021). Considering that nearly 3% of the world's annual carbon emissions are generated by the global shipping industry, the pressure to reach the international goal of zero carbon level by 2050 is increasing day by day. Therefore, aiming to reduce GHG emissions from the shipping industry, IMO has committed to reducing carbon emissions from the shipping industry by at least 50 percent below 2008 levels by 2050. The tax to be charged for international marine fuel has emerged as an important component of this strategy (Parry, et al., 2022). Since approximately 90% of the world's tradable cargo is transported by sea, it is estimated that the global tax of approximately US$ 40 per ton of CO2 will reduce CO2 emissions by 7.65% (Mundaca, et. al., 2021). Also, as an adopted revision of IMO, the international treaty of MARPOL Annex VI entails more data reporting and modest emission reductions through two measures. The measures are mandatory for all cargo and passenger ships that exceed a certain gross tonnage in international trade and registered in the countries that have signed the agreement. Due to the first measure of carbon intensity (CI) reduction requirement, shipowners should calculate an annual carbon intensity indicator (CII) for each ship, considering the amount of cargo actually carried, and also make a plan to cut the amount of carbon to achieve annual ship specific target. Through this measure to reduce carbon intensity, it is expected that a decrease of approximately %11 will be achieved in the fleet in compliant ships by 2026 compared to 2019. The second measure is The Energy Efficiency Ship Index (EEXI), which updates which updates existing energy efficiency engineering obligations for ship owners. The scope of the second measure is larger than existing energy efficiency rule (Energy Efficiency Design Index) for new ships, because EEXI also requires technology improvements for existing ships (IMO, 2021). In this line, this study aims to determine the cost effect of EU carbon levy for container ship owners. Within the scope of the study, the data on the container ships that called at EU ports in 2020, gathered from the Eurostat database will be analyzed. Annual carbon emission of each ship will be calculated by using emissions estimation model which is a core module of the bottom-up methodology in "Fourth IMO GHG Study, 2020". Results will be used to estimate the levy and additional cost per TEU to compare which capacity ships will be less affected by the levy cost.

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ENHANCING GREEN SKILLS IN MARITIME ENGLISH COURSE

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Keywords: green skills, maritime education and training (MET), Maritime English course.

Abstract: The aim of MET has always been to equip graduates with a set of professional skills necessary for their successful performance in the industry. In order to provide sustainable development and face challenges of the current environmental situation in the world, the educational system shall focus much attention on green skills development at MET institutions. Green skills are recently in high demand as many employers are interested in hiring workers in compliance with green skills criteria. However, far from all of graduates from MET institutions meet the industry demands due to lack of green skills and even awareness of their necessity. Development of green skills shall be provided by a number of professional subjects which guide students in acquiring necessary green knowledge and practicing green skills. From this perspective, Maritime English may also occupy a special place in such training.

The present paper is aimed at specifying most effective ways of enhancing green skills in Maritime English course.

To explore the attitude to green skills development and the ways to embed green skills into Maritime English course, an online questionnaire survey was undertaken for students and educators of Kherson State Maritime Academy. Maritime professionals were also interviewed concerning their experiences of green skills related to the workplace. The survey identified that in spite of their importance for the industry there is a gap between the green skills needed aboard ship and the skills actually being developed at MET institutions. The majority of maritime professionals do not consider that students always possess the relevant skills to provide safety and increase efficiency of this sector. In addition, the survey revealed that there is no clear concept of green skills. Thus, the survey indicates that students and educators consider practical involvement in protecting ecosystems, resources saving and recycling to be the most important aspect of green skills, while maritime specialists prioritise green technologies usage (energy efficiency, garbage and ballast water management) as an area for improvement. Taking into account the importance of Maritime English course as the one that significantly contributes to enhancing green skills, educators consider the broader area of green skills to develop, such as knowledge, competences, values and attitude needed to live and work at sea. As all the participants consider green skills to be an essential part of professional skills, there is a need to design “greening” course syllabus, develop learning resources and apply active learning approaches to promote green skills honing and meet the industry requirements.

Creating an Industrial Symbiosis with Ship-Generated Waste

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Keywords: Industrial symbiosis, Ship-generated waste, Sustainability, Green transition, Decarbonizing

Abstract: As widely known that the World must learn new ways of working together in order to solve the challenges of 21st century like water consumption, waste management and use of resources. By 2050, it is estimated that the world will consume three times more resources and produce twice as much waste than today [1]. This will result in intensified climate change effects, ecosystems overload and an increased landfill. Following the same path, and failing to make resources and energy consumption more sustainable could put the world in a vulnerable position. Therefore, more strategies to "close the loop" on resource use and extraction, especially in sectors with high energy intensity and environmental impacts like the process manufacturing need to be implemented.

In The 2030 Agenda for Sustainable Development, the United Nations set 17 global goals for sustainable development which are urgent call for all member countries to act. One of the main goals of this global agenda is Responsible Consumption and Production and with the specified targets of this goal, UN aimed to substantially reduce waste generation by prevention, reduction, recycling, and reuse. Encouraging companies to adopt sustainable practices and achieving environmentally management of wastes in their life cycles to reduce their release to air, water, and soil to minimize their adverse effects to the human and environment were other targets of the UN. [2]

A possible solution for this problem is industrial symbiosis, a circular business model that can play an important role in decarbonizing of industry [3]. Maritime industry can play an important role in this model. The waste generated on ships can be collected on ports and be used by the industrial symbiosis created in those areas including the ports. The challenging part and the first thing to be sorted out should be identifying which waste can be used again as a resource and then which industries to be included in this symbiosis in an optimized way considering the infrastructures. It is necessary to determine the places that can use each other's waste at close distances and its adequacy should be investigated. Also, it may be necessary to establish new centers for the recycling and reuse of these wastes.

In this study, firstly waste generated on board ships will be defined and classified according to their potential to be a raw material in process manufacturing in different industries. Then, a calculation for a selected port and time period will be done to determine the amount of waste that can be collected. To provide an uninterrupted supply chain and to avoid any shortages, liner ships that call certain ports at certain times will be the focus of this study. It will be followed by determining the suitable industries which can be included in this symbiosis to benefit from using waste generated on board ships.

This partnership will ensure that resources can be shared and reused, thus saving money, and minimizing waste. In this way, the symbiosis created will support the green transition and provide mutual benefits both economically and environmentally [4]. Also, this maritime industry-based symbiosis is expected to be a driving force for the green transition of all ports around the world. In addition to the positive effects of the investments made in this field on the environment, the long-term economic positive effects will also convince the industries to take a step in this area. Drawing a roadmap to determine how sustainable cooperation can be developed in this regard will be one of the vital steps to achieve a green future.

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Integration of Renewable Energy Sources and Smart Technologies in On-board Ships

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Keywords: Renewable Energy resources, PV system, CO_2 Emission, Pollution free Environment

Abstract: Renewable energy use is a viable approach for reducing fuel usage and greenhouse gas emissions in on- board ship. Solar power is becoming a cost-effective fuel reduction with the development of photovoltaic (PV) module technologies. Wind energy is a pollution-free, renewable source of electricity that is abundant at sea. To ensure that zero-emission oceangoing vessels are commercially available bythe mid-2030s, it is required to combine hybrid renewable energy resources and vital technologies suchas Artificial Intelligence in the maritime industry. This study looks into the viability of deploying renewable energy resources in the maritime industry using current technologies.

Is integration of renewable energy resources with Artificial Intelligence towards Zero-carbon fuels possible to decarbonize maritime shipping?

Is employing renewable energy resources to reduce shipping emissions in on board cost effective?

Renewable energy resources availability and its real-time forecasting is becoming increasingly important for utilities and grid balancing with large renewable energy capacity as wind and solar deployment grows. Predicting and estimating the variables such as wind speed, solar irradiance and the resulted power output, are required for various horizons of time, tend to range from a few minutes to an hour beforehand wherein for stabilizing the grid and scheduling the resources obtained to next-day for optimizing the unit to several days ahead. To generate forecasts over such a wide range of sizes, it is necessary to combine a number of methodologies, each with its own set of capabilities, into a single forecasting system. To maximize the predictive capacity of both, Physical and dynamical prediction methodologies are combined with statistical learning and artificial intelligence (AI) technology in best-practice systems. High-quality narrow projections on the order of a few minutes out to roughly six hours are crucial to aid grid operators in optimizing renewable energy utilization and minimizing expenses incurred in excess power integration.

In the case of marine solar power, the amount of fuel saved by using solar power alone on large ships is quite tiny. Because of the uncontrollable weather conditions. Renewable energy sources such as wind turbines and solar panels have a basic deficiency in terms of controlling the electrical generation. Aside from their comparatively low efficiency and high cost. As a result, if they are not adequately controlled, Grid Instability may occur due to the issues in the utility controls and in the worst scenario it may cause breakdown [Julián Ascencio-Vásquez, et.al in 2020]. Furthermore, the criteria for interfacing these systems to the utility are becoming increasingly stringent, requiring DG systems to deliver specific services, including as local grid frequency and voltage regulation. They are unable to provide any services due to the inconsistent and fluctuating wind speed due to which it could not give dedicated support to the system in micro grid and them on board ship, where the generators will be responsible for stable active- and reactive-power requirements.

1) The discrepancy between the generated wind power and the demanded grid power is compensated or absorbed using energy storage technologies.

2) Power distribution solutions are used to regulate the flow of electricity between diverse sources and to deliver some grid services.

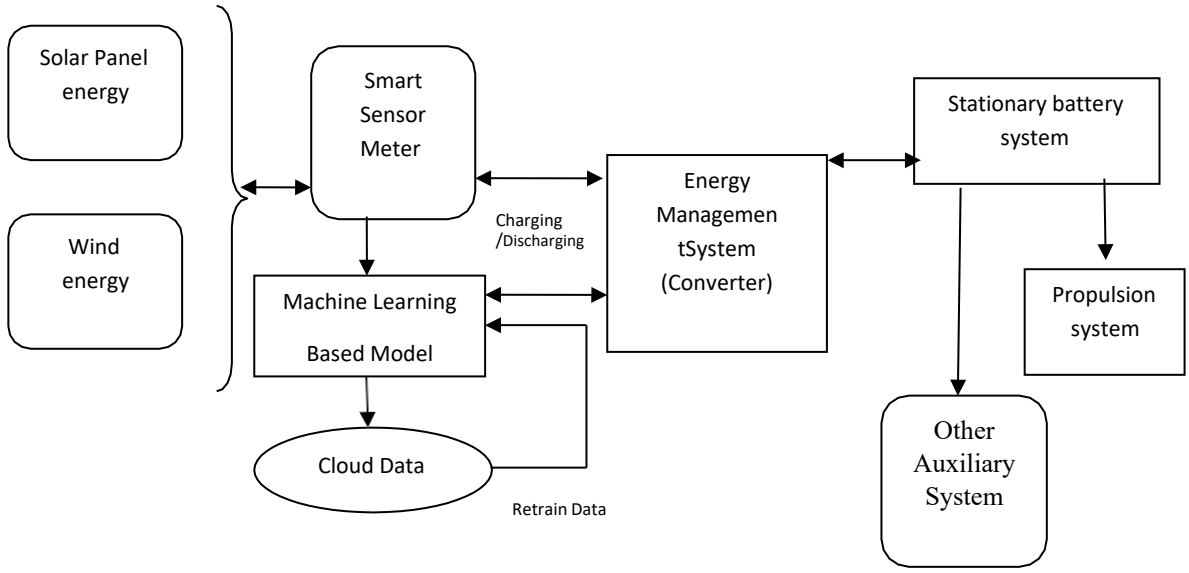

Figure 1. Block Diagram of the Renewable energy sources and AI integrated system

Distributed renewable technologies may transfer any surplus energy they produced to the grid with the help of AI software, and utilities can distribute that power to where it's essential as it is shown in the figure 1. When the requirement is less, offshore energy storing can hold surplus power while AI deploys it when production is insufficient or impractical [Branko Koovic, et.al in 2020 and Sue Ellen Haupt, et.al in 2020]. The proposed system with the deployment of AI to the Renewable energy source will provide a promising solution in onboard ships. It will lead to increased challenges in requiring synchronization, forecasting and optimization to keep the grid in balance.

It analyses the suitable technologies to be employed and the level of challenges in MET incorporation for the progression of Maritime Industry 4.0. It concludes with the possible approaches to retain and modify for upgrading the Industry towards 4.0 with the renewable energy utilization.

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Study of water treatment technologies

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Keywords: water purification, photometer, pollution prevention.

Abstract: Large volumes of world ocean water, easy accessibility, and sometimes the lack of alternative sources attract scientists to create new and improve existing cleaning methods. In terms of solving this problem, the introduction of methods for purifying water from the waters of the oceans and other highly mineralized sources, the use of water from which is impossible without special treatment, is becoming increasingly important. Purification of sea water is difficult because the level of microorganisms contained in sea water and their diversity is much higher than in fresh water. Moreover, the purification of sea water is further complicated by the fact that much more chemical compounds are dissolved in sea water, and their concentration is much higher. All of the above suggests that seawater treatment is a complex and important process.

There are a number of methods based on different physical processes, but at present they are not widely used or are at the stage of experimental models. Of all the methods of purification of sea water, we have considered and studied those methods in the process of which there is no aggregate change in water:

• Mechanical - primary settling, filtration and aeration. The nature of the pollution of the reservoir - suspended solids, acidity (pH);

• Chemical - chlorination and ozonation. The nature of pollution of the reservoir - chemical and biological oxygen consumption, ozone content;

• Osmosis process. The nature of water pollution is the content of nitrates and nitrites.

For sampling, we selected the following objects of study: the delphinium, the aquarium, the training pool of the Maritime Academy, Lake Nuri and the training vessel "Cadet". Using a bathometer, samples were taken at different depths, measurements were taken with a photometer. Appropriate conclusions will be made on the basis of the measurement results.

Previously, our studies dealt with the issues of pollution of the waters of the Black Sea coast [1], [2], [3], [4]. The current research process will contribute to the improvement of the training course “Marine Pollution Prevention and Control Methods”. And the active participation of students in the process - to mastering the skills of research, the establishment of various sources of pollution, preventive methods of pollution.

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Session
Technological Aspect

THE SEAWORTHINESS OF A TRAINING SHIP "NAŠE MORE" IN HEAVY SEAS

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Keywords: ship motion experiment, six motion components, Spotter buoy, Ellipse2

Abstract: Safe navigation through channels, straits, the open sea and oceans and the avoidance of dangerous situations at sea depend on many factors, such as the manoeuvrability and stability of the ship, the nature of the waterway, the sea state and other external factors and, above all, the seamanship of the mariner. Therefore, it is necessary to analyse the movement of the ship in different conditions. One of the most important elements for successful modelling and prediction of a ship's behaviour in heavy seas is the collection and analysis of real motion data. This paper presents the full-scale measurement of a training ship motion in heavy seas as part of a research project entitled "Modelling Uncertainty of Ship Wave-Induced Response in the Adriatic Sea (MODUS)", fully supported by the Croatian Science Foundation. The experiment was tested on the training ship "Naše more" in the port Of Dubrovnik approach area. The wave height ranged from 4ft to 6ft with SE wind. The waves came from the direction of 180 ° to 183°. The experiment lasted a total of 04:03 hours. During this time the ship was on different courses. The buoy SPOTTER was used to collect the data on the movement and height of the waves. The ELLIPSE2-N-G4A2-B1 sensor recorded the ship's behaviour and was placed in two locations: near the Center of Flotation (COF) and in the center on the bridge. The ship's motion data were collected and divided into six components in six degrees of freedom. The experiment provided a real-time graphical representation for the time series of surge, sway, and heave motions in m/s, and the Euler angle value for the roll, pitch, and yaw motions; accelerometer = aX, aY, aZ, norm; delta angle=gX, gY, gZ, velocity=north, east, down. Speed over Ground (SOG) at the time of experiment was 6 knots. The course of the research, the instruments used, and the basic measurement results are presented in this article.

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Applying CFD Simulation To Analyze Turbocharger's Impeller of Marine Diesel Engines

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Keywords: CFD Simulation, Impeller, Turbocharger, Blade Tip Clearance

Abstract: Today, the centrifugal compressors are commonly used to make in turbochargers of Internal Combusion engine, especially Marine Diesel Engines. The working process of the turbocharger will be determined the quality of the fuel combustion process in the engine cylinder. After a period of use, working, the tip blade of impeller will be worn down, it is effect to working characteristics of the engine. The technology to simulate and calculate the effect of quality and gas flow learning (CFD) is developing strongly and is widely applied in many different fields such as: aviation, marine and industrial. Research and application of CFD simulation technique to study the influence of the impeller blade tip clearance on the working characteristics of marine diesel engines is a visual method that helps us easy to evaluate properly and have an overview of the influence of turbocharger blade wear on the working characteristics of marine diesel engines. Content of the article, the research team uses the CFD simulation program to study the influence of the impeller blade tip clearance on the working characteristics of marine diesel engines and compare with the experimental results measured by the Diesel Engine Mitsubishi 6UEC33LSII when using DA3G turbocharger on board ship.

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Table 1. Impeller performance results table.

Parameters	Value	Unit
Rotation Speed	2,303.83	RPM
Inlet Mass Flow Rate	11.0690	Kgs^-1
Inlet Volume Flow Rate	4.8659	M^3s^-1
Reference Radius	0.2230	m
Input Power	119,664	W
Total Pressure Ratio	2.6103	
Total temparature Ratio	1.3470	
Polytropic Head	1,039,460	J.Kg^-1

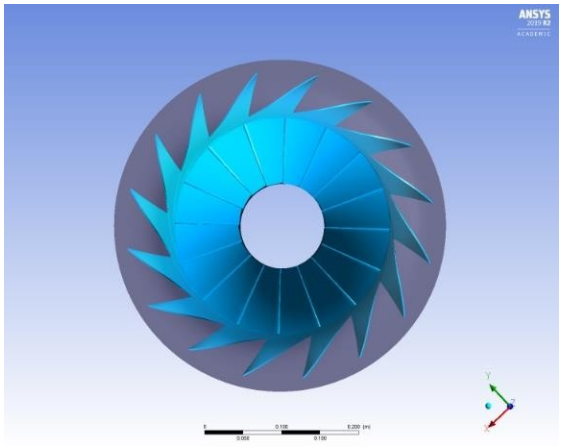

Figure 1. Blades Geometry Isometric 3D view

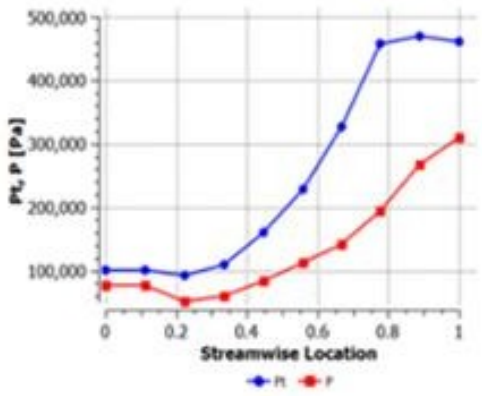

Figure 2. Pressure variation total pressure (Pt) and pressure (P) in front and behind and along the blade length.

Optimization of ship electrical power system modes according to reactive power

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Keywords: Active power losses; Reactive power losses; Reactive power compensation.

Abstract: The use of high quality electricity is essential to ensure optimal modes of the ship's electrical installations. One of the indicators of the quality of electricity is the power factor, which can be increased by reducing the reactive power. One of the ways to solve this problem is the optimal distribution of reactive / inactive power. This paper discusses the determination of reactive source capacities based on the relative growth method with minimal losses.

Many factors affect negatively on the quality of electricity. Power losses are mainly caused by: Active power (I^2 R) losses, energy (I^2Rt) losses, cable overheating and voltage drop (IR) losses. All these losses mainly depend on the current circulating in the network [1]. Also, a modern power grid is unimaginable without semiconductor converters and regulators. This in turn leads to sinusoidal current distortion (increases content of high harmonic), decreases power factort i.e. increases inactive power [5], [6], [7].

Nowadays, there are two ways to solve inactive power compensation problem [2], [3]: Reactive power compensation; Distortion power compensation. Reactive power compensator (RPC) and active filter (AF) are the basic elements of a compensating device.

Asymmetric loads occur very often. In these cases, the use of a three-phase compensating device based on static capacitor batteries is unacceptable. Due to the asymmetry of the reactive load, it is advisable to determine the compensation capacity for the individual phases individually [4].

The optimal distribution of reactive power Q, without taking into account the technical limitations, can be calculated by the relative increment method or the Lagrange method. Assume reactive power generation is not associated with any costs. Then the only purpose of the optimal distribution of reactive power should be to reduce active power losses. Using the Lagrange method [8] it is possible to determine the minimum of a function:

$$F = \Delta P + \boldsymbol{\lambda} W_Q, \tag{1}$$

$\boldsymbol{\lambda}$ -Vector of the horizontal row of the matrix [8] composed of the corresponding parameters:

$$\lambda = \frac{\partial F}{\partial S}. \tag{2}$$

$$-\lambda = \frac{\frac{\partial \Delta P}{\partial Q_{r1}}}{1-\frac{\partial \Delta Q}{\partial Q_{r1}}} = \cdots = \frac{\frac{\partial \Delta P}{\partial Q_{rk}}}{1-\frac{\partial \Delta Q}{\partial Q_{rk}}} = \text{const} \tag{3}$$

This equation allows us to determine the reactive power of all sources corresponding to the ΔP minimum losses of the active power of the network. As a result, energy losses in the grid will be reduced. It should be taken into account, to generate 1 kilowatt of electricity on average, 0.084 liters (0.07 kg) of diesel fuels are needed, which produces 3 times more mass of CO_2 (approximately 0.21 kg) [1]. Thus, the reduction of losses is directly reflected in the reduction of emissions.

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ANALYSIS OF HYDROMETEOROLOGICAL CONDITIONS IN THE MAIN GEORGIAN POTI PORT, ITS IMPACT ON THE CARGO TURNOVER AND WAYS OF SOLUTIONS

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Keywords: Poti Port, Hydrometeorological Conditions, Bulk Cargo.

ABSTRACT: The presented paper continues the previous three papers - "New Black Sea Terminal of Port Kulevi and it Navigating Features", “Analysis of Hydrometeorological Characteristics in Port of Kulevi Zone” and” Mathematical Modelling of Wave Situation for Creation of Protective Hydrotechnical Constructions in Port Kulevi” which were published in “8Th, 9Th and 11Th INTERNATIONAL NAVIGATIONAL SYMPOZIUM ON MARINE NAVIGATION AND SAFETY OF SEA TRANSPORTATION. GDYNIA, POLAND, 2009, 2011 and 2015" and where considered the aspects of safety navigation provision Kulevi port. Based on the fact that ports Kulevi and Poti are at close range of each other, for analysis of hydrometeorological conditions in the Poti port possible to use the results of research that are presented in these three papers. A favourable geographical position of Georgia - Asia, the Near East and Europe crossroads (Silk Road, Fig.1) and presence of already existed means of communication between Georgia and oil producing regions - Kazakhstan, Turkmenistan and Azerbaijan, also the necessity of search and the creation new alternative ways of safe transportation of oil to Europe and especially container cargos from Europe to Asia grants special responsibility the main Georgia cargo Poti port.

Figure 1. Silk Road in the context of Georgia.

Operator of Poti port is a APM Terminals. APM Terminals heritage terminal operations began more than half a century ago with a general cargo facility at the Port of New York in 1958. Its history in containerization dates back to Sea-Land and the very first international container operations when the Sea-Land Fairland was loaded with 236 containers bound for Rotterdam at Port Elizabeth in 1966. APM Terminals, along with Maersk Line, DAMCO, Svitzer and Maersk Container Industry combine to form the Maersk Transport and Logistics business unit.

In 2018 APM Terminals Poti (APMT) and the Poti New Terminals Consortium (PNTC) signed a Memorandum of Understanding for a USD $100 million-dollar investment in a new bulk cargo terminal. The facility will have an annual capacity 1.5 million tons of dry bulk cargo.

In 2020 APMT and PNTC have signed an agreement for the joint development of a new bulk cargo facility on the northern side of the Poti Sea Port, APMT will invest in constructing a new breakwater, 400 m of

quay wall and dredging up to 13, 5 meters vessel draft, and PNTC will invest in building a new dry and bulk cargo facility including extensive yard area and rail connection in Poti.

A favourable geographical position Poti port and increase cargo turnover should be provided by maintenance of safety navigation and minimal influence hydro meteorological conditions.

Port of Poti in the point of view of hydrometeorolgical conditions is a difficult one. The influence of prevailing wind directions – East and West, constant sea currents allows the waves to deposit the sediments in the entrance channel and that the most important unfavourable meteorological conditions contribute to closing the port for navigation for several days, which in average for each year is from 100 to 150 days.

This paper presents the analysis of hydrometeorological conditions for the creation of technical decisions which can be conducted in Port of Poti having the aim the decreasing: of hydrometeorological conditions to provide the safety navigation; besiegers sediments in the entrance channel; cases of closure of the port for navigation.

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Simulator Training beyond the boundaries of Engine Room Watch-keeping

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Keywords: emergency preparedness, autonomous shipping, future maritime training

Abstract: Traditionally and historically, engine room simulators are employed by Maritime Education and Training (MET) institutes to educate trainees to face real life machinery space situations commonly known as watch-keeping which enable safe operation of the ship. In addition, the trainees can be prepared to face the emergency situations with suitable exercises. International Maritime Organization (IMO) convention on Standards of Training, Certification and Watch-keeping (STCW) also recommends approved simulators for assessment of competency and demonstration of continued proficiency in certain areas. [1] Essentially, the scope of engine room simulator training was restricted to training engine room watch-keeping and assessment.

The capabilities of modern simulators in maritime training and education is gaining importance in recent times due to its unique features in providing integrated learning to students. Marine engineering, comprising of several facets of engineering such as Mechanical, Electrical and Electronics, Control systems, Heating, Ventilation and Air Conditioning (HVAC), finds simulators playing a vital role that surpasses any other medium of instruction. In the hands of dedicated and creative simulator instructors the engine simulators can provide another dimension of integrated learning. Simulators can be used to provide the theoretical foundation to most of the engineering concepts in various branches of engineering mentioned above. For example, the concept of reactive power in electrical engineering and its effect on the distribution system at various settings can be best demonstrated to students with advanced simulation exercises. This goes beyond the limits of traditional simulator exercise regime.

This paper analyses how the engine room simulator technology can be utilized to teach theoretical engineering concepts with carefully created simulator exercises that display various trends and relevant quizzes. The exercises do not entirely reflect engine room watchkeeping but augment theoretical engineering concepts with practicals, which may not be possible to do in a normal classroom situation or in a training ship scenario without a substantial cost / risk. Further the quizzes inserted in suitable instances within the exercise enable the student an integrated approach to purposeful learning. The quizzes further provide the instructor an authentic assessment scheme of individual student's learning and grasp of the theoretical concepts. The paper also aims to indicate that this methodology will providea pathway for training future autonomous ship operators.

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Automated Lifeboat Manifestation Embarkation System (ALMES): Facilitating Evacuation/Manifestation on Passenger and Cruise Vessels

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Keywords: SOLAS (Safety of Life at Sea), LSA (Life Saving Appliance), ALMES (Automated Lifeboat Embarkation System), Lifeboat, Evacuation

Abstract: A plethora of catastrophic disasters resulting in numerous life-losses can be noted, while searching and studying Maritime History. On a positive notion, through the course of time, the maritime industry has experienced technological innovations and advancements in many areas that truly metamorphosed the conduct of safe navigation, the radio-communications field and shed light to many chronic issues of the industry. In an epoch of various advancements in many areas of the operation of a vessel, it is quite surprising to notice that analogous progress has not been made in the manifestation and the evacuation procedures followed on cruise and passenger ships. It is worth mentioning that the mustering and life-boat embarkation procedures followed on many cruise and passenger vessels remain unchanged through the years, resembling methods followed on the early 20th century. This paper will explore the implementation of Radio Frequency Identification (RFID) and Near Field Communication (NFC) sensors, in the form of irremovable bracelets, as tools of manifestation during an "abandon-ship" scenario with the aim to minimize life-losses by facilitating a more effective and efficient means of evacuation and coordination during a ship's abandonment. The proposed system will be capable of acquiring and recording passenger and crew information carrying the afore-mentioned bracelets, during their embarkation on their designated lifeboats via the RFID/ NFC readers installed at the entryway. Furthermore, past abandonment events that led to numerous casualties are examined, as well as the current evacuation procedures followed in the cruise/ passenger vessel industry. The following study presents what currently exists in the market related to the aforementioned technology and examines the viability of creating a technologically developed evacuation system, having as a final target the creation and testing of a prototype.

Digital platforms as factor transforming maritime education and industry

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Keywords: digitalization, maritime education, maritime industry

Abstract. During the COVID-19 pandemic, many discussions arose about how digitalization is crucial for maintaining supply chains and ensuring the continuity of transport networks, especially shipping. At this stage, one of the most promising ways to improve efficiency is by introducing digitalization in the maritime industry. After all, the main goals in the information age are the digitalization of information and its proper use.

Today, the business world expects faster service, simpler processes, and better efficiency from all companies and individuals. The transition of modern society to the information age challenges one of the main tasks of education to be the formation of the foundations of the information culture of the future specialist. However, all stakeholders are connected through a network, and illustrating the maritime transport process and the roles of its participants can elucidate the special features that are unique to the industry.

Advances in information transfer, data analysis, and encryption techniques can reshape the business landscape and allow for managerial innovation, as well as new or complementary forms of learning to achieve it. But the pandemic has also led to a complete reorganization of the provision of education around the world.

In practice, the learning process has been continued through a combination of different approaches. One of them is the implementation of web-based software for the shipping industry. Its products help make accurate and efficient business decisions and are designed for brokers, operators, shipowners, research firms, and financial institutions. The purpose of the article is to consider the presented software as a tool that may support maritime education and industry.

Feasibility study on carbon capture system of LNG-fueled ship based on comprehensive utilization of heat and cold energy

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Keywords: LNG-fueled ship; Organic Rankine cycle; Carbon capture system; Waste heat recovery; LNG cold energy

Abstract: In October 2016, the Maritime Environmental Protection Committee (MEPC) of the International Maritime Organization (IMO) adopted the resolution MEPC.280 (70), namely Sulphur Limit Order 2020. Meanwhile, the MEPC has called for 50% decarbonization from the shipping industry from 2008 levels by the end of 2050. In the context of this background, liquefied nature gas (LNG) is regarded as the most feasible fuel for ships since it could reduce CO_2 emissions by 20%, NO_X emissions by 90%, and almost entire SO_X emissions. Before LNG burning in the dual-fuel engine, LNG needs to vaporize and overheat, during which about 860 kJ/kg cold energy would be discharged. On the other hand, about 50% of the fuel energy is lost as heat. Therefore, the efficient utilization of LNG cold energy and waste heat is of great significance to ship energy conservation and emission reduction.

To comprehensively utilize the cold energy and waste heat energy, this work would explore the feasibility of onboard organic Rankine cycle (ORC) and carbon capture system (CCS). The energy flow and CO_2 path of LNG-fueled ship with ORC-CCS is demonstrated in Figure 1. The onboard ORC-CCS is designed based on a VLCC routing between Shanghai and Dubai. The ORC-CCS simulation model is established in Aspen. Thermal and economic performances are studied under several different scenarios to reflect the circumstances in practice. The analyses of CO_2 emission reduction of LNG-fueled ship based on its economic feasibility are carried out. The results of this work would provide technical reference for improving energy efficiency and green shipping.

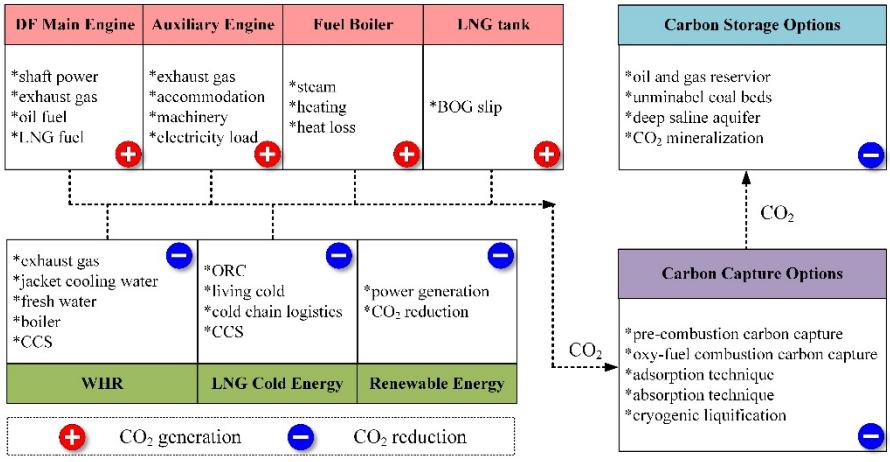

Figure 1. The energy flow and CO_2 path of LNG-fueled ship with onboard ORC-CCS

Acknowledgement

The authors would like to thank the financial support from the IAMU Research Project for Young Academic Staff in FY2022 (YAS20220201)

Towards a Cyber Secure Shipboard ECDIS

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Keywords: navigation safety, ECDIS, maritime cyber security, cyber-physical system

Abstract: The Electronic Chart Display and Information System (ECDIS) has become a major aid for safe navigation of ships. The ECDIS brings the combination of the paper charts workload reduction and real-time navigational information provision, so the ship's navigational officers can focus on the actual traffic situation, improving the safety of ship navigation [1]. The International Maritime Organization (IMO) has setup the requirement for the mandatory ECDIS carriage requirement for all SOLAS vessels [2]. With the improvement for nearly three decades, mainly by the integration and networking, ECDIS has developed in a complex cyber-physical system.

The security risks rising from the application of cyber technologies in ECDIS systems has been recognized by the IMO, and therefore the general cyber security guidelines for safeguarding the ship navigation are recently published [3]. In addition, the cyber security risks must be adequately implemented in the International Safety Management (ISM) code and periodically audited for ISM code from the beginning of the year 2021 [4].

In this work, we present a comparative study of cyber security threats in ECDIS systems that are implemented on board of three ships, the *Kraljica mora*, *Aida IV*, and *Kapitan Gregorio Oca* (Figure 1). In order to perform the comparative study, a computational vulnerability scanning of the ECDIS systems was conducted using an industry leading software tool [5-7] and by applying the same scanning model (Figure 2). The ECDIS systems' technical specifications and experimental details will be presented. The cyber security threats identified together with feasible mitigation measures will be presented.

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(a) (b) (c)

Figure 1. The training ships: (a) *Kraljica mora*, (b) *AIDA IV*, and (c) *Kapitan Gregorio Oca*.

(a) (b) (c)

Figure 2. Cyber security testing of the ECDIS systems implemented on the training ships:
(a) *Kraljica mora*, (b) *AIDA IV*, and (c) *Kapitan Gregorio Oca*.

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Acknowledgements

The materials and data in this publication have been obtained through the support of the International Association of Maritime Universities (IAMU) and The Nippon Foundation in Japan.

Head-worn Display Utilization in Engine Supervisory Work

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Keywords: situation awareness, trust in automation, workload

Abstract: Recent smaller formation of onboard teams demands more efficiency in allocating the jobs. Especially for the engine supervisory work where the operators have more portion of monitoring task but still needto undertake maintenance in the engine room. Besides having sufficient non-technical skills, task allocation can be supported by utilizing the cognition aids, such as a head-worn display. However, a promising result of utilizing it in the work areas is not without a trade-off. This study examined its implementation by measuring workload, situation awareness, and trust in automation. These measurements are generally used to evaluate the human-machine interface in the process control [1].

To replicate the work of the engine department, we use an engine plant simulator as the experiment setup. It consists of a separated engine room with three monitor displays to mimic the system and engine control room with engine control console installed. Twelve students from the marine engineering department joined as the participants. An experiment design employed *2 x 2* within-subjects. All participants experienced two conditions of available information on head-worn display (information-on, information-off) and two conditions of activated alarms numbers during the task (high-task with 12 alarms, low-task with 6 alarms). During the experiment, participants have to conduct two tasks simultaneously: maintenance tasks at the engine room and monitoring tasks from the engine control room. Furthermore, two kinds of alarms were introduced: true alarms that need the participant's response, and false alarms that can be safely neglected. We measured the workload, situation awareness, and trust in automation using questionnaires after each scenario. In addition, objective measurements were observed using the response time to the alarms and the number of the completed tasks.

The workload measurement found that participants perceived a lower workload when information was available on the head-worn display. This suggests that when the participants have information to confirm an incoming alarm, whether true or false, they can safely neglect to return to the engine control room and effectively reduce the workload by moving less frequently. Available information also makes participants put more trust in the alarm system. In addition, it allowed more maintenance tasks can be finished at the engine room side. However, situation awareness that we thought would increase if the participants had information on the head-worn display did not make any difference. It explained the trade-off between increased attention supply and increased attention demand made by the complicated visual environment while using the head-worn display. Moreover, the time spent checking the information on the head-worn display also leaves the response time to the alarms became longer. We see this trade-off between suitable response action and longer response time is acceptable.

The results show the promising advantage of head-worn display utilization as the cognitive aid for onboard engine supervisory work. Several trade-offs occur and can be examined using available human factors evaluation measurement. Understanding the limitation of utilizing it provides good feedback during the design process. It also shows the benefits of including human operators in the design loop process.

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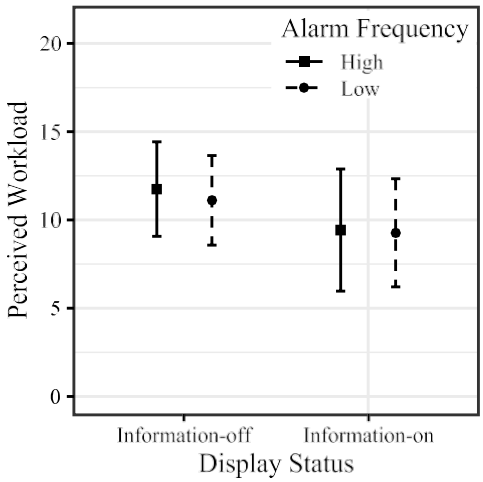

Figure 1. Perceived workload

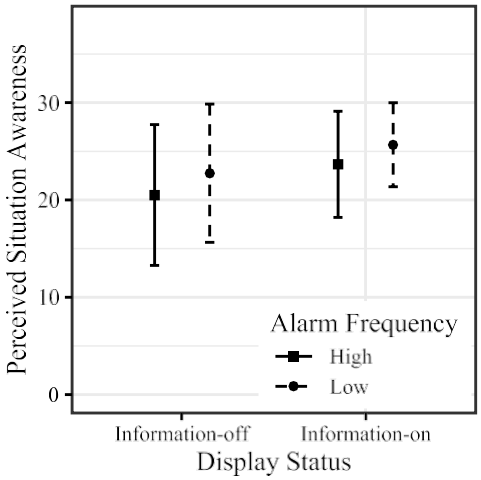

Figure 2. Perceived situation awareness

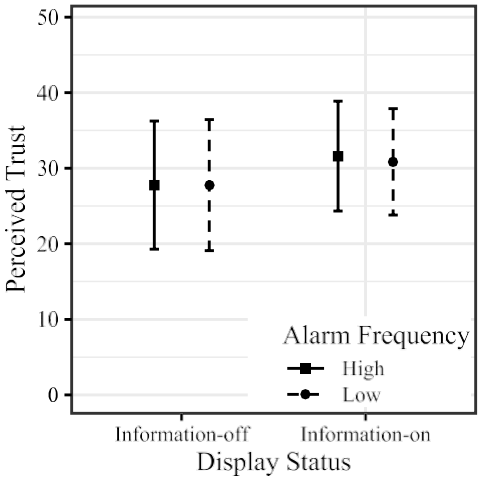

Figure 3. Perceived trust in automation

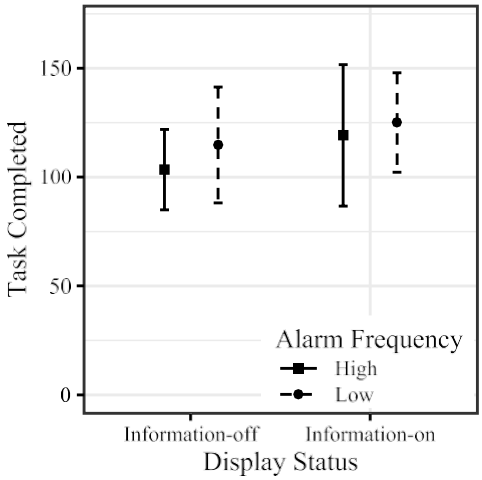

Figure 4. Total completed task

Acknowledgements

This research was funded by JSPS KAKENHI Grant No. 21K04517.

A Study of H-Bridge Multilevel Inverter Driven Marine Propulsion System

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Keywords: PV system, Wind energy conversion system, multilevel inverter, FPGA controller, Total harmonic distortion.

Abstract: On account of non-availability of non-renewable resources, Greenhouse gas emissions, CO2 emissions, environmental aspects increased the utilization of alternative energy resources for marine applications. This implementation leads the maritime industry to energy-efficient, low-pollution ships. The sea business, among every other industry, is being compelled to steadily diminish its discharges. The current work fills the need of a typical purpose of social event, tending to, and clarifying the most recent updates, past accomplishments, and future focuses of the shipping industry [J. P. Trovão et.al].The industry research main goal is to create a multi-level inverter for a diesel/wind/PV/battery hybrid power system with an induction generator (IG) for a wind-energy conversion system and a synchronous generator (SG) for a diesel-generator (DG) installed onboard a ship. Maximum Power Point Tracking (MPPT) techniques have been used to get the most out of renewable energy such as solar and wind. In this article, to increase PV system power generation, an MPPT technique that combines incremental conductance and constant voltage MPPT algorithms is used. The Wind Energy Conversion System (WECS) now has an Optimal Power Control MPPT technique in addition to pitch angle control.

Multilevel inverter topologies provide lower THD, lower EMI generation, a better output waveform, and higher efficiency for a given output waveform quality. Majorly used multilevel inverter topologies for improvement of power quality issues are flying capacitor multilevel inverter (FCMI),diode clamped multilevel inverter (DCMI), and cascade H-Bridge inverter (CHB). Cascaded H-Bridge topology has been chosen in this paper to design the multilevel inverter. Pulse width modulation techniques help the switching of Cascaded H Bridges to obtain an approximate sine wave output from multilevel inverter. The carrier-based modulation called level-shifted modulation is considered for CHB. Using level-shifted modulation, (m-1) triangular carriers with the same frequency and amplitude are required for an m-level CHB inverter [Rodr'iguez J et.al].In addition the DC output voltage is regulated by a hybrid buck boost converter. A battery bank system is linked across the RES as a storage system to satisfy the need of the emergency load. The regulated DC output is fed to the 13 level H bridge inverter to enhance the performance of the hybrid system. This combination can satisfy the voltage to load in the desired level [Babaei Ebrahim el.al].H-bridge multilevel inverter improves the voltage profile. The switches of the inverter are controlled by the FPGA control that balances and provide an adequate power to the driver circuit. For a 13-level output voltage, the FPGA chip generates 16 control signals. A Cyclone FPGA chip is a programmable logic device (PLD) that can be used for rapid prototyping. Because of its high computation speed and ability to produce accurate control signals, the FPGA chip was chosen for the hardware implementation of the control circuit. The switching strategies are modelled in VHDL and Quartus II is used as a simulation and compiler tool. The compilation produced 1250 logic elements with a thirteen-level output voltage.

The PWM outputs are terminated in a 34 Pin Connector (P4). The induction motor coupled with the propeller

adjusts the speed of the propulsion drive. Thus, a novel approach is proposed where the maximum amount of energy is generated by RES and utilized for marine application. As a result, fuel costs and greenhouse gas emissions are reduced. Simulation results are obtained using Mat lab Simulink and the same has been implemented in hardware.

Figure 1 shows the structure of the hybrid system in which PV and Wind energy conversion system.

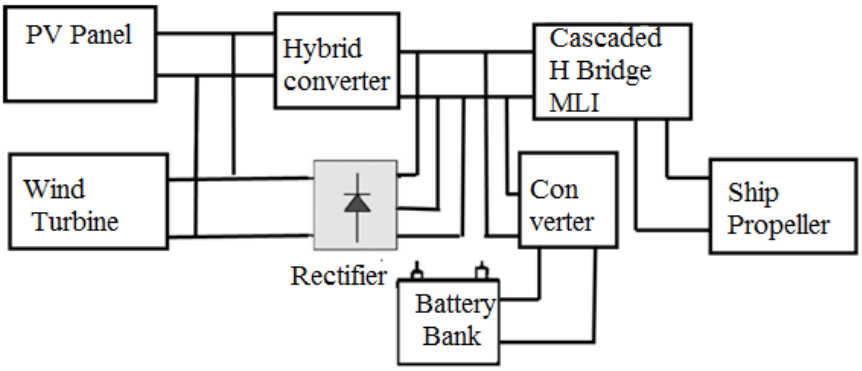

Figure 2. Structure of Hybrid power system for Marine Applications

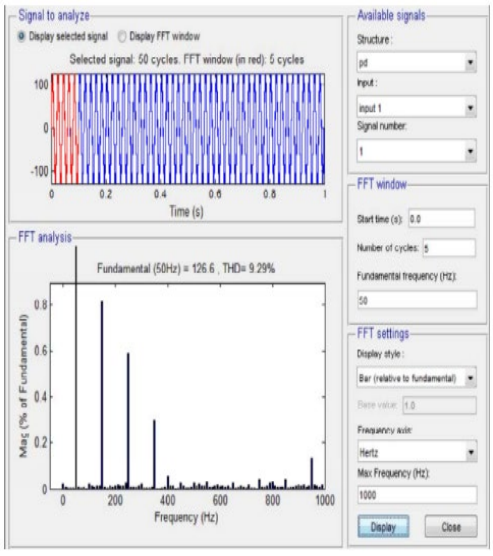

Figure 3. Analysis of THD level without RLC filter

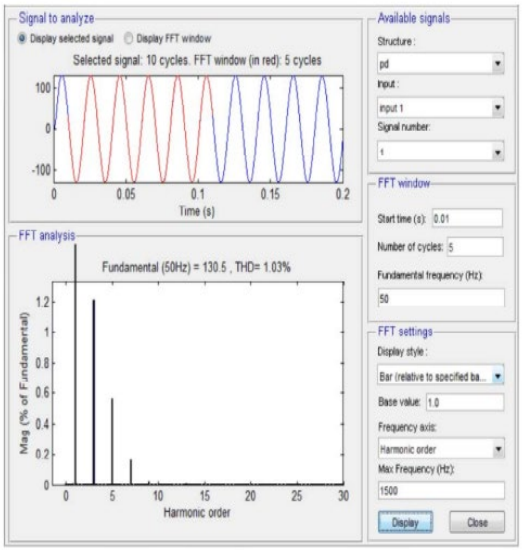

Figure 4. Analysis of THD level with RLC filter

Figure 2 and 3 illustrates the level of THD obtained with and without RLC filter in the MLI.

Simulation and experimental results obtained have shown that the system is designed well and the load current and voltage of 1.03% THD rate is maintained in the standard limits for multilevel inverter with RLC filter to get a smooth sinusoidal output. The proposed configuration results in a compact and low-cost system with lesser switches and switching states, as well as a simplified inverter control circuitry.

Acknowledgement

The first author Dr. T.Sasilatha, Professor and Dean sincerely acknowledges the financial assistance received from All India Council for Technical Education, India under Research Promotion Scheme [File No. 8-248/RIFD/RPS(POLICY-1)/2018-19]

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Session

Economic Aspect

South China Sea Contentions and the Economic Sustainability of Shipping Industry

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Keywords: economic sustainability, shipping efficiency, South China Sea conflicts

Abstract: As a vital artery of commercial waterways connecting Asia with America, Europe and Africa, South China Sea is an essential maritime passage for many economies, including USA, China and Japan. Each year, South China Sea claims estimated one-third of global shipping, with roughly $5.3 trillion worth of goods transiting through the sea routes. However, for a long period of time, South China Sea is subject to several overlapping territorial disputes involving China, Vietnam, the Philippines, Taiwan, Malaysia, and Brunei. Since the past two decades, the territorial disputes have been escalating to potential military conflicts and "set in motion a rapid arms race for the countries involved." (see Cosar & Thomas, 2020) The potential clashes, especially among big military powers, could lead to disruptions of the South China Sea waterways, and force trading countries to reduce international trade, divert to alternative sea routes which is cost inefficient for shipping companies, and hinder economic growth for the involving countries.

The paper intends to examine how contentions in the South China Sea would impact negatively international trade and sustainability of shipping industry. Applying available datasets associated with the topic, the paper looks into how political instability and military tensions in South China Sea could lead to changes in productions and supply chains of the relevant countries, such as Taiwan, China, Vietnam and Philippines, and their economic growth for the foreseeable future.

The question of how to keep sustainable growth of shipping industry has become even more crucial after the outbreak of Ukraine - Russian crisis three weeks ago. The well-beings of the world and global economic developments demand a peaceful solution to the disputes in South China Sea, rather than confrontations of any kinds in the region.

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Efficient Management of Portfolio Resources

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Keywords: Decision Support Systems, Portfolio Optimization, Investment Analysis, Management of Financial Resources

Abstract: An extended definition of logistic domain is related with management operations of different categories of resources: materials, information, finances, energy, human resources. The management in logistic operation implies optimal resource allocation which insists the definition and sequentially the solution of appropriate optimization problem. Thus, optimal resource allocation is found for transport operations, establishment of warehouses, financial planning and investment, managing human resources, definition of optimal scheduling in working operations. This research addresses a particular topic for optimal financial resource allocation by portfolio optimization. The modern portfolio theory is a tool for formalization and quantification the decision making in investing and financial management of assets. The paper addresses particular issues of definition of portfolio problem. A management policy is developed which makes optimal allocation of financial resources for cash allocation in certificates of deposit with different duration; support of safe amount of financial resources in the end of each month, taking in consideration the needed payments per month. This optimization problem is solved by using EXCEL software suit. Particular tool as Solver function is applied. The paper presents a solution which is practically used for the management of small and medium enterprises. The added value of this research concerns the quantification and optimization of financial resources for logistic management.

Defined and solved optimization problem:

$$\min_{x,y,z}\{\sum_{k=1}^{12} A_1 l_1\, x(k) + \sum_{k=1}^{9} A_2 l_2\, y(k) + \sum_{k=1}^{6} A_3 l_3\, z(k)\}$$

$$V(k+1) = V(k) + x(k)A_1(1+l_1) + y(k)A_2(1+l_2) + z(k)A_3(1+l_3), \quad k=1,\ldots,6$$

$$V(k+1) = V(k) + x(k)A_1(1+l_1) + y(k)A_2(1+l_2), \qquad k=7,\ldots,9$$

$$V(k+1) = V(k) + x(k)A_1(1+l_1) \qquad k=10,\ldots,12$$

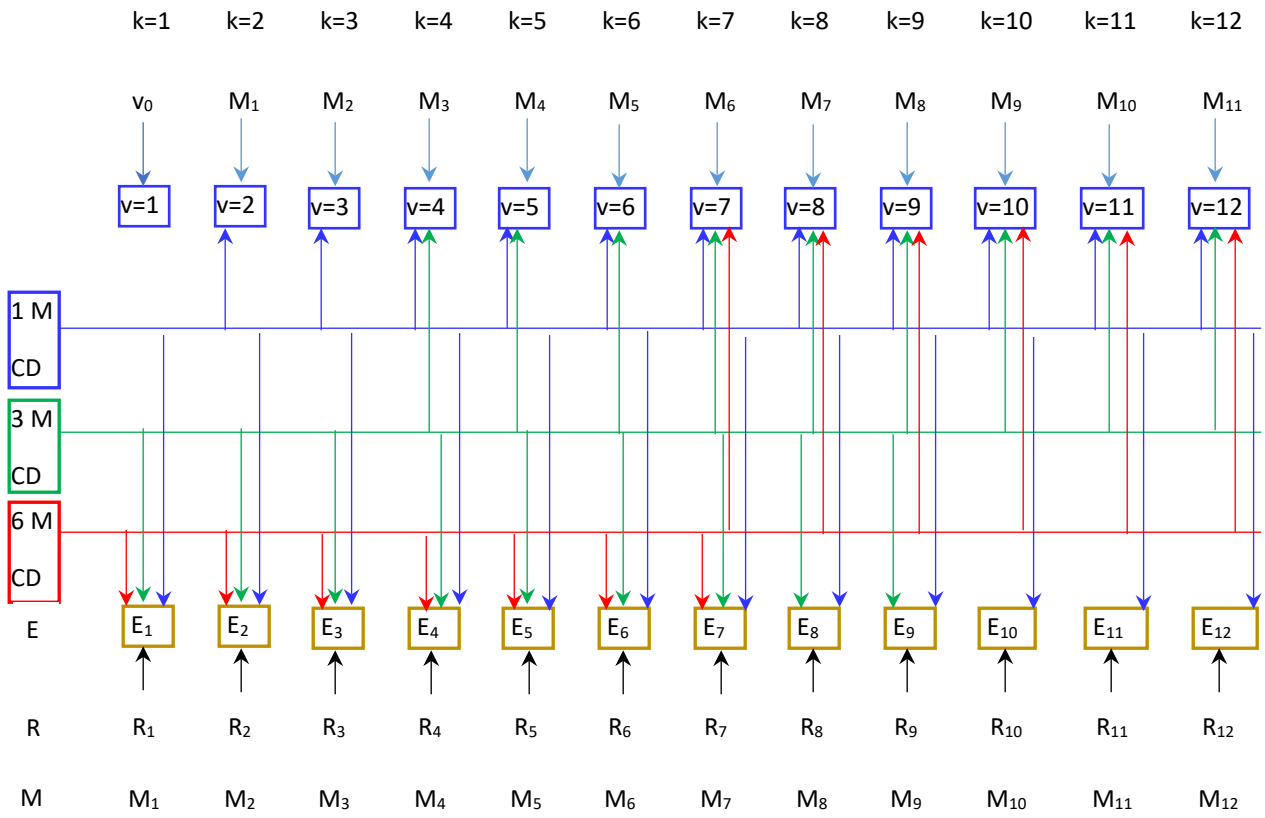
$$V(k) \geq 5000,$$

$$x, y, z \geq 0,$$

$$x, y, z = integer$$

A_i , i=1,2,3 - Required amount for 1Month CD, 3 Month CD, 6 Month CD

$l_i,\ i = 1,2,3$ − Interest rates for 1Month CD, 3 Month CD, 6 Month CD



1 M CD – 1 Month Certificate of Deposit

3 M CD – 3 Month Certificate of Deposit

6 M CD – 6 Month Certificate of Deposit

E – Expenditures

R – Monthly Costs

M – End of Month

x – number of 1 MCD

y – number of 3 MCD

z – number of 6 MCD

$M_i = v_i - E_i$, $i = 1,\ldots,12$

Final:

$$\max_{x,y,z} F(x, y, z)$$

The impact of process innovations on the maritime transport services

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Keywords: maritime transport services, technology, innovations, entrepreneurship

Abstract

Background: It has been established that the favourable factors affecting the development of maritime transport services in Bulgaria are the advantageous location of the country, the existing transport infrastructure and its links to the railway network. These favourable factors create conditions for the introduction of new system innovations in the management of these services.

Objective: The aim of this study is to analyse the impact of four key process innovations on the maritime transport services provided by leading companies in Bulgaria. In particular, the process innovations studied are: improved provision of services; specification of services aimed at new market segments; creating better conditions for realization of the services offered; introduction of new organizational innovation. Seen from another research angle, process innovations will have an impact on the economic and social environment of the sector, as well as on subsequent innovations and prospects for the maritime industry.

Methods: This study applies a method to identify the Factor effect (screening) design resulting from the numerical value scores by indicator given by experts to executives of leading organizations in the maritime sector of Bulgaria. The method makes it possible to determine the impact of the four key process innovations and identify the variation of the different scores. On this basis, the research approach adopted allows for a comparative analysis of the expert assessments and ensures reliability and validity of the results.

Results: The comparative results (including measurement uncertainty) show no significant differences in the assessments by experts of the impact of various innovations on the maritime industry. The results also show that the factor with the greatest significance for maritime transport organizations is the introduction of organizational innovations (streamlining the processing of offers and reducing execution time), the utilization of new markets and the provision of new services in the sector. Furthermore, the results attest to the priorities for the sector and the problem areas in its future development.

Conclusion: The results from the overall study show that the introduction of process innovations in each of the four areas would be advantageous for the development of maritime organizations in Bulgaria. In addition, the synergistic effect of innovations would benefit the development of human resources and new technologies of management of the maritime industry in Bulgaria.

The Predictive Ability of Ocean Freight Rates: Evidence from Japan

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Keywords: Ocean freight rates, forecasting, Japanese freight transportation industry

Abstract: This study examines the role of global ocean freight rates on local domestic transportation freight rates in Japan. Japan is chosen for this study because of extensive monthly domestic freight rate data available from the Bank of Japan, and because prior research on the maritime industry in this country has been limited. Data used for this study include monthly freight rate data on four different domestic freight transportation sectors in Japan. Measures of global ocean freight include a measure from the Bank of Japan and the Baltic Dry Index (BDI).

While much prior research has shown that ocean freight rates such as the BDI can predict a variety of macroeconomic factors (Ghiorghe and Gianina, 2013; Bildirici et al., 2016), only limited research has been done showing the interrelationship between ocean freight rates and domestic freight rates. U.S. ocean freights were found in one study to have no significant impact on road, rail, or air transportation freight rates in the U.S. (Shackman et al., 2021). This may be a result of the U.S. Jones Act, which makes sectors of the U.S. transportation industry uncompetitive. Japan, unlike the U.S., has a vibrant ocean transportation industry including some leading global competitors such as K-Line, Mitsui, and NYK.

Data for this involves monthly data from the Bank of Japan (BOJ) covering 1999-2021. The specific series used for this study includes data on domestic water transportation (inland and coastal), rail, road, and air freight rates. For ocean freight rates, two measures were used. One is a measure of freight rates from the Japanese-flagged international fleet from BOJ. The other measure is the BDI, which is a widely used measure of ocean freight. Relationships between the different freight rates were assessed through the use of Granger causality and a vector autoregressive (VAR) model. This allows us to test to see if a change in a freight rate this month leads to a change in another freight rate the next month. Bidirectional causality was tested for all freight rates.

Our results indicate that both the BOJ ocean freight index and the BDI are strong predictors of domestic Japanese freight rates. The BOJ index was a strong predictor of all four domestic freight rates, and the BDI was a significant predictor of three out of four domestic rates. Interestingly, we found little predictive ability between domestic freight rates. The one exception is that both road and air freight rates predict rail freight rates. These results are illustrated in Figure 1. Overall these results suggest that while Japanese ocean freight rates reflect global market competition and are useful for practitioners to predict trends in the domestic freight industry. Rail appears to occupy a competitive space between road and rail, perhaps competing with road for low-value cargo and air for high-value cargo. However, the overall minimal interrelationship between domestic freight rates suggests a possible lack of competition or inefficiency in these sectors. Future research should be done to assess how labor shortages, regulations, or infrastructure may be limiting competition in these sectors.

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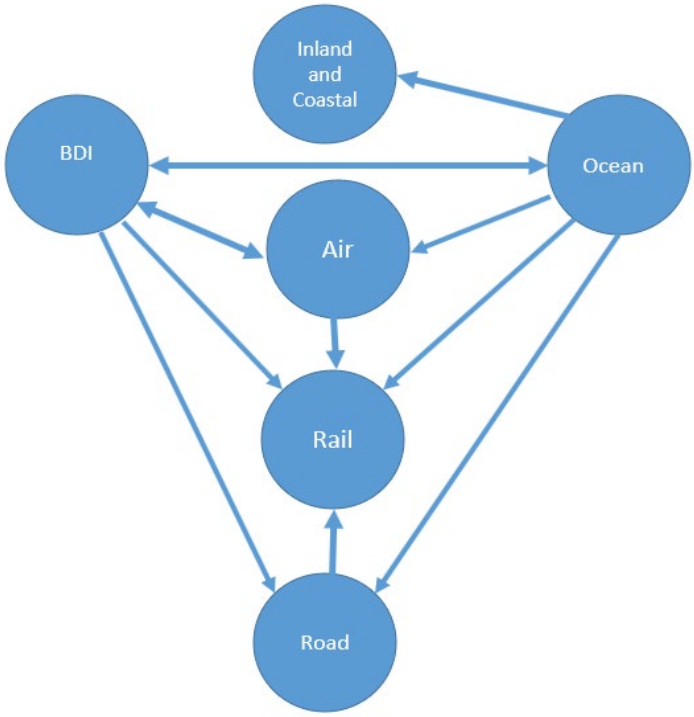

Figure 1. Causal relationships between ocean freight rates and domestic freight rates.

Maritime Labour Market Dynamics (MLMD) and Futuristic Approach in Remodeling Skilled Global Maritime Labour (SGML)

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Keywords: Maritime labour market, Labour skills, Future demand and supply, model course, up skills

Abstract: Oceans are very vital for humans because holding 97% of water, 70% of the oxygen we breathe, ecosystem,food, energy, trade and leisure (1). Almost 40% of the world's population lives near the coastline (2). Theglobalized maritime industry with more than 740,000 merchant ships transporting 90% of the world's cargowith around 1.89 million seafarers (3). If the oceans were a country, it would have the seventh-largest economy in the world (4). Millions of workers executing maritime operations on hi-tech ships, ports, offshore installations, and terminals.

The world will be experiencing a few megatrends like more globalization and digitalization, navigating towards hi-tech-oriented work environment and demanding high skilled workforce. Sustainable development is impossible without upskilled or reskilled labour force (5). Labour Market Dynamics (LMD) is always changing, attributable to demand and supply, matching efficiency, innovations, high-tech systems, education level, productivity, unemployment etc. Maritime labour market data shows a decline in job offers especially ratings whereas officers are in access. This may be more diverse with the induction of autonomous shipping. Supply and demand affected during recent times due to Covid -19 pandemic and the Russian / Ukraine conflict because these two countries make up 25% supply of seafarers (6).

Wags dichotomy and unemployment not only because of labour skills but also because of the nationality of the crew. MET institutes are lagging in coping up with the fast-changing technologies. There is a wide gap between hi-tech maritime hardware and labour skills because maritime training institutes and STCW are not at par with modern maritime inventions. Updating process of STCW is obvious in these concerns. Skilled Global Maritime Labour refers to highly educated, well trained, experienced, and dedicated; physically and mentally fit to perform complex tasks. That needs prolonged and extensive professional training to compete with the maritime labour market demands. It needs to know the labour market requirements, supply and demand and employee preferences.

This paper highlights MLMD and SGML and suggests MET institutes for a futuristic approach for remodeling maritime labour skills; train them in labour market changing dynamics, up skills, tricks and trades for seeking and retaining a job, progression, and becoming an efficient, effective, and skilled maritime team member. A survey through IAMU member universities will present a very clear picture of the issue. Paper suggests approaching IMO and IAMU to introduce Maritime Labour Market Skill Course in collaboration with the ILO and other maritime stakeholders. It also suggests IAMU Maritime Skilled Labour Data Program (MSLDP), IAMU Maritime Labour Market Data Program (MLMDP), and IAMU Maritime Skilled Labour Standards (MSLS) according to maritime industry requirements. (Fig -1). This Data will provide a very sophisticated way for the maritime labour market and maritime labour force to interact for future employment. (7).

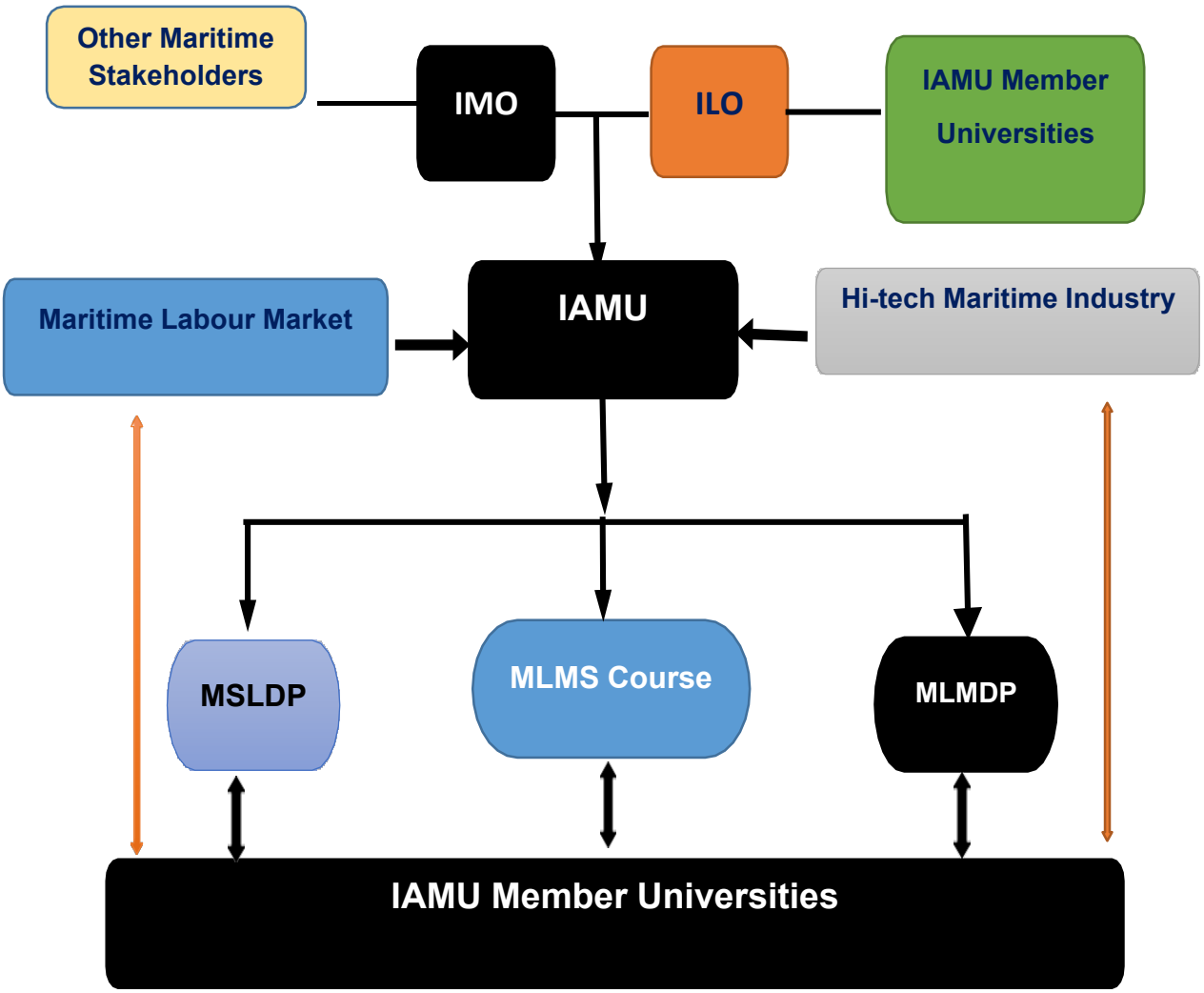

Fig-1. Feedback system to provide skilled maritime labour to the maritime labour industry ©

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The Role of Digitalization in the Shipbroking Business

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Keywords: shipbroking, sustainability, supply and demand, structural holes theory, blockchain

Abstract. The shipbroking discipline is the only non-regulated interdisciplinary subject providing consultancy service to the shipping world. Traditionally, practitioners provide tailor-made services to their clients by finding the best possible ships for the cargoes and, in return best possible cargoes for the ships. Consequently, brokers have to be familiar with the specific market such as supply and demand, specialization in the dry or wet market, sales and purchase market, specialized in specific geographical areas, and finally plays as a bridge between the principals and try to resolve any dispute with their diplomatic skills. There are no strict requirements to enter into this business, which makes the business more vulnerable, and as it is easy getting into this business, it is, in the same way, easy to get rid of the Shipping as well. The paper investigates the sustainability of the shipbroking business and its' short and long-term consequences and adaptability of the new technological developments and regulations that the shipping industry must comply with.

Session

Social aspect

Analysis on influencing factors of career choice of Chinese students majoring in the navigation based on discrete choice model

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Keywords: Students majoring in the navigation, career choice, discrete choice model

Abstract: In view of the current situation that the onboard employment rate of navigation students in China is declining year by year, this paper constructs a discrete choice model to empirically study the influencing factors of navigation students' employment. By analyzing the survey data of students from the Department of Navigation Technology and Department of Marine Engineering of a maritime undergraduate college in Shanghai, the study found that the love for navigation, the expected high income after graduation and the family's support for their children's maritime career are the main factors to promote the employment of navigation students working on board, while the strong social capital of the family is the biggest resistance. Based on this, this paper puts forward several targeted suggestions to promote the high-quality and sustainable development of the crew.

Leveraging a visible learning process in higher distance education: a case study in International Maritime Management, M.Sc.

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Keywords: maritime education and training, distance learning, lifelong learning, nautical officers

Abstract: This paper presents an update on the student cohorts enrolled in the post-graduate, distance-education course of International Maritime Management, M.Sc. (IMM). This study course enables sea-faring nautical officers to combine their work on board ships with a distance-education university degree course at Master's level (L7 according to the European Qualifications Framework [1]). The flexible didactic concept allows seafarers to proceed in their learning progression despite limited access to the Internet on board sea-going ships, and other professional and personal duties during the time they do not work at sea [2].

Given the uniquely difficult learning situation of active seafarers, implementing a tailor-made degree course has not been an easy undertaking. At the onset of the course, there were uncertainties as to the feasibility of its didactic concept. The study course was trialled in a two-year test period and has been offered as a regular degree course since September 2017. Over the total period, intensive evaluation activities have been carried out to assess the applicability of the developed instructional design. This paper synthesises some cohort figures. Following the presentation of these empirical data, a discussion is presented on student success. The didactic elements of IMM are reviewed and inferences are made in relation to their contribution towards successful completion of the degree course.

The presented research aims not only to enhance the IMM degree course but also to further improve the learning environment experienced by mainly mature higher-degree students at large. Therefore, it serves as an example of good practice in terms of Maritime Education and Training (MET) and Research in general. Additionally, the concept bears potential in terms of transferability to other IAMU member universities as it could serve as a starting point for future concepts and a sustainable development of MET generally. This discussion is becoming increasingly important in the area of tension between the predicted officer shortage, increased workload, decreased crew sizes [4; 5], the impact of New Work [6] as well as the requirements of future competencies for seafarers due to change drivers and trends in the maritime industry [7].

In addition, with this innovative approach it is shown that active seafarers are given the opportunity to develop their necessary skills for and continue their own Lifelong Learning and Continuous Education [8; 9]. Attending programmes tailored to their as well as these needs is necessary, especially in the light of the increased degree of digitalization and the Fourth Industrial Revolution [10]. This methodology strengthens Lifelong Learning in general and gives maritime professionals the chance to continue their education while working at sea and to prepare for interwoven sea-land-careers and future work demands in particular [11; 12].

Furthermore, the past semesters have shown that the concept of the study course presented is crisisproof. Overall, Covid-19 pandemic has had only limited impact on it. Right from the start, the IMM distance

degree course has been designed along the needs of seafarers and it had not to be converted at the beginning of the crisis. Therewith, the presented research serves also as an example of good practice in order to illustrate the difference between distance learning and emergency remote teaching.

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Preliminary results of the identification of entrants' approach towards maritime career

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Keywords: maritime education, maritime training, seafarers, employment policy, maritime transportation

Abstract: In perspective of diminishing attractiveness of a career at sea and the continued growth of the fleet, the aspect of promoting employment at sea among young people, especially women, is in the spotlight. The 2010 International Convention on Standards of Training, Certification and Watchkeeping (STCW) Convention encourages the international community to promote sea-going employment among young people, especially women [1]. With tens of thousands' shortage in the number of qualified officers [2-4], the future of industry responsible for as much as 90% of global trade [5] is at stake [6]. Various solutions are proposed, including attractive cadet trainee programs, to encourage young people to work at sea and pursue their careers over the years. However, it remains unclear what are the main thoughts of the entrants while enrolling in a maritime education and training (MET) institution. To investigate this issue, a seven-year study has been performed on the newly-enrolled Navigation students of the Gdynia Maritime University by paper-based questionnaires distributed to them on one of their first courses at the University. The herein paper presents the initial results of the study which we intend to continue and possibly expand. Different aspects of entrants' attitude towards their career development like motivation to join the fleet have been investigated.

The results of this study may prove valuable in determining future seafarers employment and retention policy-making recommendations aimed at attracting new entrants and retaining them in a number sufficient to sustain the operations of maritime transportation. Additionally, identifying the social aspects of further seafarers can be important in relation to the prospective implementation of Maritime Autonomous Surface Ships.

Future research directions include expanding the study involving cadets from other universities and departments (like Marine Engineering). Performing such cross-national study would be a good opportunity to also strengthen inter-MET cooperation and create a global framework for attracting new entrants.

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A Ranking of Critical Competencies for Future Seafarersin the Scope of Digital Transformation

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Keywords: maritime industry 4.0; maritime digitalization; digital transformation; maritime competence; fuzzy analytic hierarchy process

Abstract: Industry 4.0 has ushered in a new era of information technology, which has also affected the maritime industry. With the introduction and integration of Internet of Things (IoT), Big Data, Artificial Intelligence, Cloud Computing, Digital Twin, Blockchain and automation technologies in the previous decade, the Industry 4.0 digital revolution has evolved. This digitalization is forcing maritime industry, as well as all other industries, to look outside of their scope, forcing them to constantly redefine their previous practices in order to keep up with the changing world. The digital shipping revolution, Shipping 4.0 [1], paved the way for the concept of autonomous transportation in the maritime industry. Moreover, with the introduction of Maritime Autonomous Surface Ships (MASS) significant developments have taken place over the last few years by academics and the International Maritime Organization (IMO). These developments are mostly focused on technical advancements and implementations regarding autonomous systems. However, the gap between common practice, competence and future opportunities is observed to be growing [2]. It has been observed that the maritime industry's employment pattern will be drastically altered as a result of these technological advancements, necessitating the availability of highly qualified human resources [3]. Therefore, the skill standards for seafarers will need to be reviewed as part of the digitization process [4]. Therefore, this paper focuses on identifying and ranking the emerging critical competencies for future seafarers due to the reflections of Industry 4.0 in the maritime sector.

Four key competencies and twenty sub-competencies were identified and structured preliminarily, with a focus on the new competency requirements discussed in the literature (Table 1). Data from maritime sector experts will be gathered using a questionnaire survey. Academic experts in the maritime industry will examine and validate the survey's content. The questionnaire will be dividedinto two sections. The first section will involve demographic questions, and the second section will allow respondents to rate the relative importance of paired criteria of the sub-competencies on a scale of '1 = extremely unimportant' to '9 = extremely important.' The data collected will be analyzed using the fuzzy analytic hierarchy process. The analytic hierarchy process (AHP) is a practical method for assisting in decision-making by utilizing a structural hierarchy of various criteria. However, AHP is also challenged for inaccuracies due to an inability to compensate for ambiguity in human logic. As a result,fuzzy logic is combined with AHP to reduce such ambiguity. Therefore, FAHP is regarded as a suitableanalysis method in this study.

The aim of this study is to contribute to the literature about the competencies that future seafarerswill need in the digital era. The rapidly widening gap between the current qualifications and the future needs shows that a strategy should be determined in the short, medium and long terms in this regard. While these strategies are being determined by all the stakeholders of the maritime industry, it is aimedto create a critical competency ranking that they can consider.

Table 2. Overview of future seafarers' competencies

KEY COMPETENCIES	SUB-COMPETENCIES	LITERATURE
OPERATIONAL	Operations Monitoring and Analyzing	Cicek, K., Akyuz, E., & Celik, M. (2019), Oksavik, A., et.al. (2021).
	Information and Data Processing	Tran, T. N. M. (2018), Oksavik, A., et.al. (2021), IAMU(2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021)
	Programming	Tran, T. N. M. (2018), IAMU(2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Shahbakhsh, M., Emad, G. R., & Cahoon, S. (2022)
	Ability to Manage Cyber Security	Sharma, A., & Kim, T. E. (2021)
	STEM knowledge	Tran, T. N. M. (2018), IAMU(2019), Sharma, A., & Kim, T. E. (2021), Emad, G. R., Enshaei, H., & Ghosh, S. (2021), Shahbakhsh, M., Emad, G. R., & Cahoon, S. (2022)
	Law and Legislation awareness	IAMU(2019), Cicek, K., Akyuz, E., & Celik, M. (2019)
COGNITIVE	Problem and conflict solving	Nguyen, L. (2018), IAMU(2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Kilpi, V., Solakivi, T., & Kiiski, T. (2021)
	Reasoning and Decision making	IAMU (2019), Cicek, K., Akyuz, E., & Celik, M. (2019)
	Ability to cope with complexity	Tran, T. N. M. (2018), IAMU(2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021)
	Critical Thinking	Nguyen, L. (2018), Tran, T. N. M. (2018), IAMU(2019), Sharma, A., & Kim, T. E. (2021)
SOCIAL	Communication	Tran, T. N. M. (2018), IAMU (2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Oksavik, A., et.al. (2021), Shahbakhsh, M., Emad, G. R., & Cahoon, S. (2022)
	Teamwork	Tran, T. N. M. (2018), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Oksavik, A., et.al. (2021), Kilpi, V., Solakivi, T., & Kiiski, T. (2021)
	Adapting to cultural differences	IAMU (2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Oksavik, A., et.al. (2021)
	Leadership	Nguyen, L. (2018), Tran, T. N. M. (2018), IAMU (2019), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Oksavik, A., et.al. (2021), Emad, G. R., Enshaei, H., & Ghosh, S. (2021), Shahbakhsh, M., Emad, G. R., & Cahoon, S. (2022)
INDIVIDUAL	Adaptability and Flexibility	Tran, T. N. M. (2018), Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021), Kilpi, V., Solakivi, T., & Kiiski, T. (2021)
	Energy Efficiency Knowledge and Awareness	Tran, T. N. M. (2018), Cicek, K., Akyuz, E., & Celik, M. (2019)
	Sustainable point of view	IAMU (2019), Cicek, K., Akyuz, E., & Celik, M. (2019)
	Ability to work under pressure	Cicek, K., Akyuz, E., & Celik, M. (2019), Sharma, A., & Kim, T. E. (2021)
	Self-Learning Motivation	Nguyen, L. (2018), Cicek, K., Akyuz, E., & Celik, M. (2019)

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Promotional Strategies for Gender Equity in Maritime Sector: Maritime Education Institutions

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Keywords: Maritime Sector, Maritime education Institutions, Women, gender Equity, Financial Assistance, Employment, Enrolment

Abstract: Women are most important and effective pillar of the successive economic enterprises. Due to customs and traditions of the many of the countries they were denied to showcase their talents in the public forum and they were forced to take care of their family and children. Gender equity in the workplace environment is the dream of the many social activists during 18th century and now it's become true by the continuous efforts from the bottom level to educate the women and providing promotional avenues in the workplace. Maritime sector is the most important economic sector which provide the direct and indirect employment opportunities to the majority of the world population. Gender equality in the maritime sector is dream for the women still now where there is a lot of schemes and supports were rendered to them. BIMCO/ICS 2021 Seafarer Workforce Report highlighted that 45.8% increase in women seafarers were projected when compared to the 2015 report. But, this projected 45.8% increase is just 1.2 % of the global seafarer's population in the historically male dominated maritime sector. This study is an attempt to identify the factors influencing the women to join the maritime education institutions and barriers faced by the women seafarers to provide the promotional strategies to increase the number of girl cadet enrolment in the maritime education institutions. The snowball technique have been employed to collect the information from the 153 women cadets in the pre sea courses. It found that economic barrier is the one of the major problem for the women to join the pre sea courses. The parents were unable to pay the higher fees compare to the other courses available in the Arts & Science and Engineering streams. After sending the girl cadets to the pre sea courses their parents were still worrying about the employment opportunity in the male dominated industry and struggles to pay the fees for their wards. Girl cadets in the pre sea courses were suggested to promote the pre sea courses in the rural and semi-urban places with the career opportunities and also to provide more financial support for the women cadets enrol in the pre-Sea courses. This study suggest the strategies to promote gender equity through Government and Private parties involves in the Maritime sector should take necessary initiatives offer more fellowships or free ships to the eligible/meritorious Women cadets enrol in the maritime education institutions to increase the admission and which will contribute the increased women participation in the maritime workforce as a whole. Further, number of empirical studies have to be conducted among the women cadets in the pre sea courses in all the countries to identify the varied needs of them to ensure the prosperity of gender equality in the maritime sector.

Knowledge representation in MET

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Keywords: STCW knowledge representation, GMP, semantic analysis

Abstract: Maritime education and training (MET) may be described as a systematic process utilised to transfer knowledge and accumulated experience to students. The scope and extent of subjects to be delivered are predominantly determined by the job description and assumed responsibilities. Consequently, there are different levels, both in scope and depth. The minimum knowledge and competencies for different levels and functions are internationally agreed upon and codified in the International Convention on Standards of Training, Watchkeeping and Certification, 1978 (STCW).

Due to recent accelerated technology development, many have raised the question of the "appropriate" level of knowledge and competencies for future seafarers. The knowledge and competencies traditionally delivered at MET institutions are confronted with changing shipboard organisation, new technologies (particularly communications and AI), accelerated business activities, etc. At the same time, the core set of competencies given in the STCW Convention has not been updated since 2010 or in several subject areas even since 1995. Consequently, the skills gap between given standards and industry needs is clearly recognised. The number of new or revised non-mandatory courses is increasing as well as a list of IMO approved Module Courses, with more extensive stakeholders' involvement than ever. Even the GMP initiative, promoted by the IAMU, may be understood as a response to these needs by systemising and generally improving the knowledge delivery at the global level, thus improving the efficiency of the MET as a whole.

The maritime professional knowledge, once a sole responsibility of the national authorities, today is to a large extent internationalised and represented in internationally recognised documents. Due to the numerous proficiency levels and activities, maritime knowledge is dispersed in numerous documents, with different obligatory levels, scopes, objectives, styles, structures, etc.

However, in most cases, professional knowledge is represented as statements describing the abilities the students should master during the educational process. Such an approach, in general, follows the well-known Bloom's taxonomy. It is understood as a common language to facilitate communication on learning objectives across persons, subject matter, and levels. Yet, it is not used consistently, and in different documents, the target competencies, although very similar, are represented in very different arrangements.

Therefore, the research presented in this paper aims to identify the modes of knowledge representation and their characteristics in different documents. The research is based on the semantic analysis of the knowledge statements in relevant international sources using a corpus-based approach, relying on the concept of semantic frames (cf. Fillmore & Baker, 2010). The selected knowledge sources include:

- Core STCW competencies (extracted from the STCW Convention)
- Extended STCW competencies (as represented in the STCW Code A & B, without Chapter I)
- Description of competencies at management and operational level in associated Model Courses (Deck, Engine, ETO)

- GMP Body of Knowledge, as the most sophisticated document describing curriculum development for maritime professionals
- IAMU AGA proceedings (AGA 19, 20 and 21), as a corpus representing MET teachers' perspectives and interests.

Each corpus represents the common maritime knowledge differently, depending on goals, point of view, intended scopes, audience, etc. It is important to note that selected corpora cover all aspects of maritime knowledge: factual, conceptual, procedural, and metacognitive knowledge (as defined by Krathwohl, 2002) and therefore may be considered representative for the language register.

The linguistic analysis has been carried out for each corpus to identify the most frequent words (verbs, nouns, collocations and multi-word units), readability statistics, etc. The basic analyses are accomplished using the Sketch Engine corpus analysis tool. In addition, several analytical tools, such as textual similarity measures and readability, have been implemented in R to gain insight into the semantic similarity or distance among these sources. In addition, the usage of the action verbs, identified by the IMO as the preferred ones for use when developing Model Courses, has been analysed. The corpora include 1,143,631 tokens, or 912,155 words. Furthermore, the knowledge generation measures are discussed, particularly processes that may help MET institutions improve their knowledge management performance.

For example, preliminary findings regarding the use of action verbs, shown in Table 1 as relative frequencies in the mentioned corpora, indicate that the domain of cognitive learning is much more prominent than other domains. However, the data suggest a certain similarity in the use of these verbs between the Core STCW and the Extended STCW which differs from the other three corpora, particularly GMP in the domains of psychomotor and affective learning.

Table 1. Relative frequencies of action verbs in the corpora

	Core STCW	Extended STCW	Model Courses	GMP	IAMU AGA Proceedings
COGNITIVE LEARNING	24736	19549	28795	25802	15960
PSYCHOMOTOR LEARNING	11658	11530	7689	4754	6013
AFFECTIVE LEARNING	2316	2619	3815	8414	2250

Further research based on corpus and statistical data would aim to build semantic frames around the verbs and compare these across the five corpora to gain an insight into the way maritime knowledge is encoded.

Finally, based on the outcomes of the analyses, the possible further steps to increase consistency in the knowledge representation are proposed, with particular references to GMP.

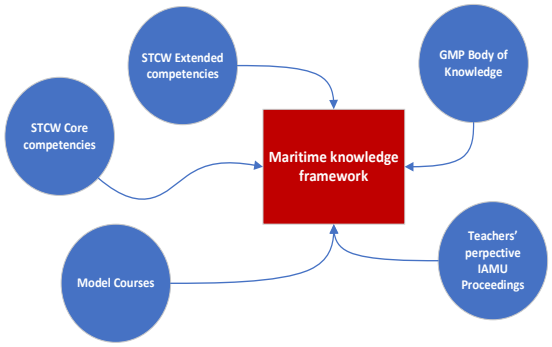

Figure 5. Maritime knowledge framework

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Acknowledgements

The part of the research presented here has been initiated and carried out within the SkillSea project (a project funded by the European Union, Erasmus+ program grant – 2018-3387/001-001 Project number 601186).

Determination of critical risk factors that prevent in-ship communication during ship operational processes

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Keywords: communication barriers, critical risk factors, prioritization, numerical risk analysis

Abstract: In-ship communication is critical for the successful execution of operational processes such as loading, unloading and maneuvering on ships. Interruption of in-ship communication for any reason not only causes these operational processes to fail, but also can lead to serious accidents. In addition, as a result of these accidents, death, injury, damage to ships and port facilities, environmental pollution and serious legal problems may occur. In this respect, establishing an effective and uninterrupted in-ship communication during ship operations will significantly reduce the risk of accidents. In realizing this, it is of great importance to determine the critical risk factors that create barriers for in-ship communication. In the study, as a result of detailed examination of academic publications, codes, circulars, safety guides as well as consulting expert opinions, risk factors that prevent in-ship communication were determined. Using these risk factors, a comprehensive survey was created and an assessment of each risk factor was taken by an expert group familiar with ship operational processes. Obtained feedbacks were prioritized by performing Analytical Hierarchy Process (AHP). As a result of the analyzes made, it was concluded that the risk factors that most negatively affect on-board ship communication are due to the lack of training and individual factors. In the study, recommendations were made to increase the efficiency of on-board ship communication and to eliminate the identified risk factors. The outputs of the study will be used by shipping companies' training and crew departments, various level training organizations, ship masters, officers and all crew members.

Mitigating maritime unemployment in Georgia: A Maritime Education and Training perspective

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Keywords: Maritime Education and Training (MET), Georgia, unemployment, lifelong learning for seafarers

Abstract: It is globally reported that qualified seafarers are in shortage and the seafarer demand is always higher than the actual seafarer supply (BIMCO and ICS, 2021). Despite this trend, some maritime education and training (MET) institutions, including the Batumi State Maritime Academy (BSMA) - Georgia, are struggling to find employment for their students. According to the BSMA graduate survey in 2019, deck and engine cadets who found a job were 52% and 50% respectively (BSMA, n.d.). At the national level, the Maritime Transport Agency of Georgia (2021) reports that among 264 graduated students from three maritime universities in Georgia, only 171 were employed as cadets by the authorized crewing companies, indicating that the unemployment rate among cadets was 53%.

Nevertheless, maritime employment is an important career opportunity for young people in Georgia as its seafarer employment has been increasing in recent years. In 2020, a total of 3,553 Georgian seafarers, including 1,749 officers and 1,804 ratings, were employed (Maritime Transport Agency of Georgia, 2021). On the other hand, the youth unemployment rate (aged 15-24) in Georgia was recorded as 39.7% in 2020, which appeared to be the worst in the region (World Bank, 2021). It is therefore urgent to minimize the unemployment of MET graduates and further increase maritime employment for Georgian youth.

This paper addresses the employment challenges faced by cadets in Georgia and identifies possible solutions from a MET perspective. Secondary data analysis was conducted using the published survey data about BSMA graduates as well as employers. The analysis helped understand the current problems with the BSMA graduates and identify a gap between MET provided and employers' feedback about BSMA graduates' knowledge and skills. Employers were generally unsatisfied with the graduates of marine navigation, particularly in their ability to draw conclusions; theoretical knowledge; applying knowledge in practice, and ability to work in a team. The BSMA student survey also shows that the majority of marine navigation graduates (82.6%) found a job outside of their specialization. Based on these results, a series of document analyses were conducted to analyze the current BSMA curriculums in terms of possible causes for the identified gaps. In addition to the gap analysis, another document analysis about new development for MET in Georgia was exercised to consider future opportunities for quality MET. Such new development includes the Poti branch of BSMA and a multifunctional pool for practical training. It is assumed that new MET development in Georgia will support the mitigation of unemployment among MET graduates and increase maritime employment opportunities.

In a conclusion, the paper also looks into the lifelong learning opportunities for Georgian seafarers to strengthen their capacity in human capital development and provides recommendations for MET in Georgia in preparing for sustainable shipping globally (Bogusławski et al., 2022).

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Enhancing "soft skills" management for maritime and shipping business personnel using interactive educational methods

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Keywords: soft skills, human errors, maritime safety, interactive education, case study method

Abstract: The paper presents an interactive approach for educating and enhancing "soft skills" management for maritime and shipping industry personnel. Considering the growing numbers of maritime incidents caused by human errors due to communication problems, intercultural and gender differences, leadership, ethical or moral issues a comprehensive framework for teaching "soft skills" is proposed. The first part of the paper aims to build an understanding on the concept of soft skills in maritime education referring to a number of personal qualities, habits, attitudes and social characteristics that make someone a good employee or member of an organization who is preferable to work with. Described are the most common and general soft skills which often appear as part of the cause for maritime incidents- leadership through positive influence, decision making, team work, communication, negotiation, conflict management and time management. Professionals working in the maritime sector acknowledge implementation of soft skills. This will ultimately facilitate better onboard working environment leading to improved productivity.

The second chapter offers an approach based on using case studies for developing soft skills in maritime education. [1] Case studies rely on real situations involving real events. They provide descriptive situations that stimulate the trainees to analyze and propose decisions. The purpose of the case method is to make trainees apply what they know, develop new ideas to manage a situation or solve a problem. The focus is more on the approach the trainee uses rather than on the solution. As a training tool, the case study method can be used to developing decision-making skills, enhancing team spirit, better communication and interpersonal skills as well as strengthening analytical skills of trainees. Once the trainer can use the case study technique with confidence, he can continue with using more advanced methods such as role-plays, simulation exercises etc. The methods offer very interactive communication between trainee and trainers, that result in a more interesting and modern way of influencing and motivating trainees to actively participate and cooperate during the teaching and learning process.

The third chapter presents initial empirical results from applying the case study method to develop soft skills among a group of students from four different countries and maritime academies. The results evaluate the level of applicability of the method, the teaching approaches and the assessment of the gained knowledge and perspectives for implementation in professional environment.

Acknowledgements

[1] This research is part of European project "Innovative Soft Skills to Maritime Education and Training", funded by Erasmus + program under section KA2- Cooperation for Innovation and the Exchange of Good Practices" (2014-2020).

The Importance of ESP (Maritime English) in the Maritime Industry for Safety Maintenance On-board and Ashore

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Keywords: Maritime English, ESP, Human factor, Competency-based learning outcome, safety

Abstract: The 21st century is an era where knowledge of English language plays a pivotal role in the Maritime Industry. Seafarers are required to know as General Maritime English in order to operate and communicate successfully on-board and ashore. Since the crew members could consist of different nationalities and English language might not be their mother language, ambiguity and confusion may take place while communicating, which can lead to human error and can be the direct cause towards accidents. That is why Maritime English, as one of the sub-fields of ES, is built on specific terms and phrases which were elaborated and adopted by the maritime and shipping community. In 2001 the SMCP entered into the Maritime field and as IMO suggests they 'have been developed to cover the most important safety-related fields of verbal shore-to-ship (and vice-versa), ship-to-ship and on-board communications. The aim is to get round the problem of language barriers at sea and avoid misunderstandings which can cause accidents.

Hereafter, the major goal of these terms and phrases is to decrease human error accidents caused by language and communication. The paper considers reviewing the importance of effective communication in ESP, namely, Maritime English for safety maintenance on vessel and ashore. It highlights international developments aimed at ensuring that seafarers gain the appropriate skills and knowledge to communicate effectively and efficiently in ESP for avoidance of the regulation of safety standards resulting from miscommunication among non-native speakers of English. The aim of the article is to identify the gaps in ESP competence (at the level receptive and productive skills) in current curriculum for safety operations; to elaborate effective strategies for improvement of the learning component of the curriculum and to offer practical solutions and recommendations in redesigning existing teaching methodology in the ESP. To achieve the above-mentioned goals, a small-scale blended type of survey will be conducted among undergraduate Bachelor and Master students of Batumi State Maritime Academy.

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THE IMPACT OF THE RUSSIA-UKRAINE WAR ON THE DEVELOPMENT OF CRUISE TOURISM IN THE BLACK SEA REGION

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Keywords: cruise industry, military crisis, black sea cruises, Russia-Ukraine war

Abstract: Not fully recovered from the two-year coma caused by the pandemic and its repetitive Covid-19 waves, the cruise industry has received another blow at the worst possible time. Geographically European military crisis has left almost no one aside and is impacting economic, political and social life worldwide. The Black Sea cruise tourism has borne the overwhelming brunt of Russia's Invasion of Ukraine, which has also affected some part of the Baltic Sea. Prominent cruise lines reacted quite quickly to the upcoming distress. The three cruise giants Royal Caribbean, Carnival Corporation and Norwegian Cruise Line Holdings have canceled their trips to the Black Sea region and swapped Russian destinations for Swedish. According to the managing director of Fred. Olsen Cruise Lines Peter Deer, the safety of their passengers is the number one priority, and this is the reason they have altered their itineraries to no-Russian-ports destinations. [1] MSC Cruises, AIDA Cruises and TUI Cruises have followed the Norwegian Cruise Line's suite and scrapped all their trips to Russia, Ukraine ports.[2]

After the 2020-2021 cruise stock depression caused by Covid-19, which resulted in $ billions of loss, cruise lines are facing another crisis, a European humanitarian catastrophe that reveals financial results, that are more than disappointing.[3] The Black Sea region appears to be utterly deserted of cruise ships without any perspective to flourish in the light of the war.

CLIA (Cruise Lines International Association), in its 2022 report states that the industry has proven its incredible resilience and passenger flow will surpass 2019 levels by the end of 2022. [4] The forecast for the cruise world is more than promising. Meanwhile, in the sight of the unfolding Black Sea countries crisis, the cruise picture of the region is changed almost completely. According to Cruise Industry News, 21 cruise ship was scheduled to operate in the Black sea region in 2022. [5] However, the only cruise line claiming a full go for the Black Sea program is Russia-state owned cruise company "Black Sea Cruises" [6].

The paper studies all the variables and aspects of the cruise industry in the scale of the region and recent events. The study aims at providing a thorough analysis of the crisis and its impact on the cruising perspectives of the region.

The analysis is based on an external and online desk research methods. The data contains market analyses, official journals, expert opinions, official industry reviews.

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MET in Ukraine in time and after of Russian invasion

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Keywords: MET, War in Ukraine

Abstract: Ukraine is one of the leading crew supply country. More than 200 shipping companies work with Ukrainian seafarers.

On the 24th of February 2022 by the Russian invasion the world has been change. The ongoing armed conflict between the Russian Federation and Ukraine presents a serious and immediate threat to the safety and security of crews and vessels operating in the region. Ukrainian ports are closed, some of Ukrainian city under temporary occupation by Russia.

There are four IAMU member institutions in Ukraine:

- Kherson State Maritime Academy, Kherson
- National University "Odessa Maritime Academy", Odessa
- Odessa National Maritime University, Odessa
- State University of Infrastructure and Technologies, Kyiv.

The war in our country is the main obstacle to provide students and cadets quality MET. Educational institutions can provide on-line education only and no practical training. More than one third part of lecturers are out of Ukraine. The Government financial support to the educational institutions is reduced to critical minimum.

By the restriction to cross the Ukrainian boarder for men in age 18-60 years old the onboard training is huge problem for our maritime cadets. Many cadets on board of the vessels cannot return to home by the logistical challenges. Many students and cadets try to continue education abroad of the Ukraine.

Unfortunately, in the post-war devastation, maritime education is not a priority for the country.

International efforts of the marine industry are needed to support maritime educational institutions in Ukraine.

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Re-envisioning Maritime Education and Training – Technology facilitated lifelong learning for future ship operators

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Keywords: Maritime Education and Training; Lifelong learning; Blended learning; Maritime Autonomous Surface Ships; Activity System

Abstract: The increasing introduction of novel and digital technologies on-board ships is changing the landscape of work and the seafaring skill and competencies required to perform the job. The maritime industry currently finds itself in a dynamic evolutionary continuum culminating in the techno-saturated realm of Maritime Autonomous Surface Ships (MASS) of the future. This ongoing transition to future ships foregrounds the continuous and lifelong learning for seafarers to remain relevant as the industry irrevocably progresses and evolves. Meanwhile, the imperative incorporation of new technologies in Maritime Education and Training (MET) during the COVID-19 pandemic disrupted the traditional classroom-based teaching-learning process. Even though this accelerated technology adoption in MET was not free from challenges, it cemented the trend of technologically facilitated maritime blended learning and e-learning. This paper notes the need for lifelong learning in an industry in a flux and the maritime education system undergoing a transition. Seafarer training as we know today cannot serve the needs of future operators who would not be physically present on-board autonomous ships. This paper suggests that the proliferation of on-board technology needs to be complemented by technology in education and training. Furthermore, technology facilitated lifelong learning is imperative for current seafarers to remain relevant.

Technology facilitated continuous lifelong learning is the way forward in the maritime industry; for seafarers/operators, training establishments, and stakeholders within maritime clusters. This paper captures the maritime higher education activity system in transition utilising activity system analysis. Additionally, the paper utilises the trends identified in the literature – increasing digitalization and on-board automation, and the increasing adoption of technology in MET to extrapolate and depict the education and training activity system for future ships. MET as it currently stands is inadequate for MASS operations. Furthermore, the industry preference for lifelong learning over formalised education will shape training for future MASS operators in the years to come. In the technology rich environment, industry and education stakeholders will increasingly design and provide modular training aligned with MASS requirements to support seafarers/operators along their journey of lifelong learning.

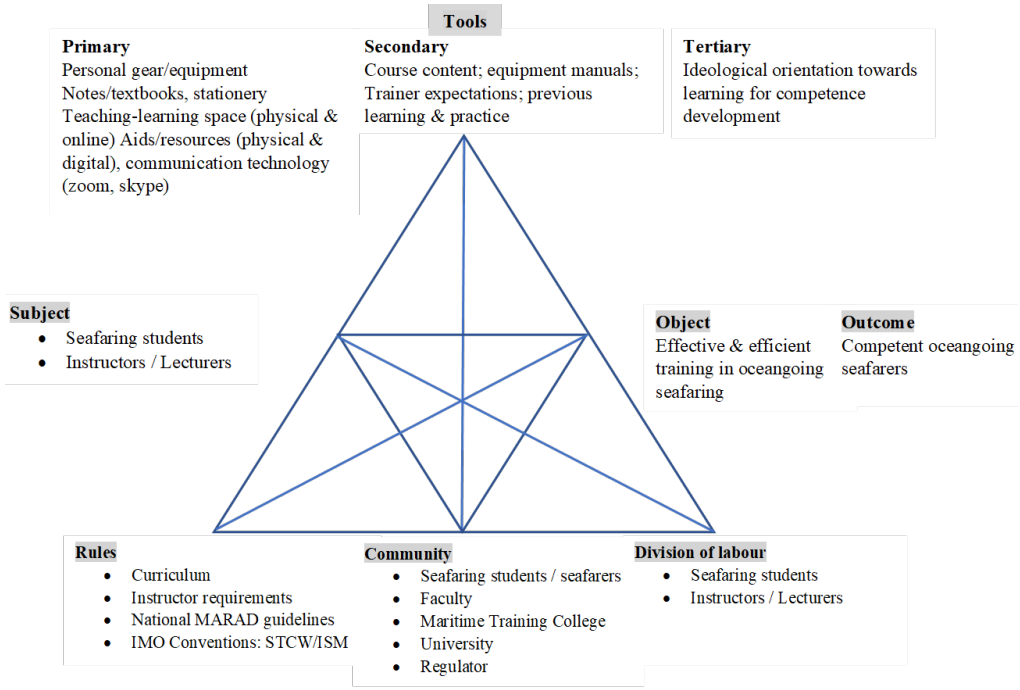

Figure 1. MET Higher Education Activity System – in transition
Source: Adapted from (Emad & Kataria 2022, forthcoming)

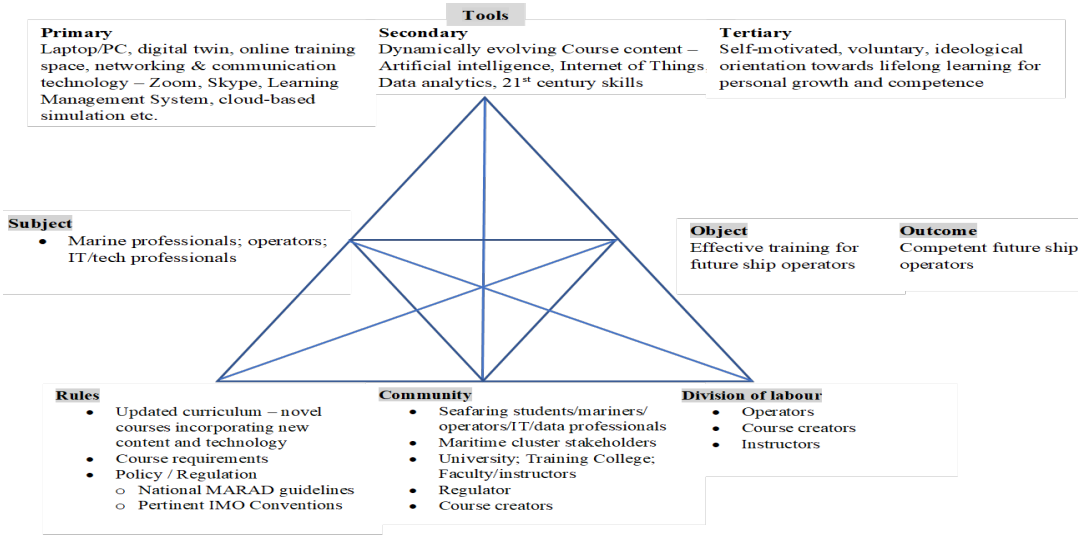

Figure 2. Education and Training Activity System for Future Ships.

Source: Authors

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The (ir)Relevance of Current Maritime Education and Training in the Transitioning Workplace: An Activity Theory perspective

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Keywords: Maritime Education and Training, Cultural-Historical Activity Theory, Digitalization, Automation, Human-machine Interactions; Cognitive Human Element

Abstract: Over the past two decades, the maritime industry is experiencing a phase of rapid digitalization and automation. Modern ships are built, increasingly fitted with novel technologies and complex tools and that is changing the ways in which seafarers are performing their jobs. However, researchers are now questioning the efficacy and ability of the present-day maritime education and training in developing the skills and competencies needed in a dynamic work environment. The main reason for the above being the many recent maritime accidents and incidents wherein the causal factors are attributed to seafarers' lack of expertise in timely recognizing and responding to developing hazards. Traditionally, seafarers developed their competencies through authentic participation in shipboard activities, under the guidance of experienced seniors. However, with digitalization, various tasks onboard ships are getting internalized, leaving no clues about the inner workings to an onlooker, and this in turn, is adversely affecting the apprentice's learning opportunities onboard. Studies also show that in a technology-rich workplace, with limited number of human operators overseeing multiple, complex tasks, can often cause job intensification, operator's cognitive overload, error in judgement, and costly accidents. A review of literature indicates a paucity of studies that focus on the cognitive human factors and competence development of seafarers, that is relevant for a high-technology future workplace. This paper partially addresses that gap by proposing a novel, practice-based approach, to analyze the challenges arising onboard ships in the transition period leading to a digitalized future. We propose the cultural-historical activity theory (CHAT) or simply, Activity Theory as a suitable theoretical lens that can provide a holistic socio-technical perspective on the happenings on board. Within this view, the learners, mentors, technologies, pedagogical values, roles/identities, and rules/cultures, all act as interdependent elements of a single collective activity system. It is only through identifying and resolving any contradictions, incoherencies, and dilemmas that exist between these elements, we can hope to achieve the desired outcome, in this case, competent mariners who can safely operate highly digitalized future ships.

From Enterprise Resource Planning (ERP) to Universities Resource Planning (URP)

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Keywords: E-University; ERP; URP.

Abstract: In the article is discussed and analyzed the importance of the Enterprise Resource Planning (ERP) principles in the University environment. University, as an organizational form, it is crucial to properly evaluate the effectiveness of administrative and academic staff performances. In the last couple of years besides the negative impact, COVID-19 had a positive impact on the technological development at the HEIs. So, the ERP system remains a powerful program that allows businesses to systematize all important processes. Doing so drastically reduces costs and the possibility of making mistakes, thereby increasing efficiency and profitability.

Essentially the ERP system comprises the main sections of an organization, such as financial, human resources, production, logistics etc., but to the present does not cover the whole university's administrative and learning activities. Thus, most of the HEIs effectively implemented technologies and E-systems but in most cases are fragmented and do not cover whole university activities.

The purpose of the article is to create one, united platform based on an ERP system, whereby we'll get the new model of the University Recourse Planning (URP) system and will be implemented and facilitate the: unified digital database, improvement of university efficiency, less bureaucracy, delayed decisions and the and quality improvement.

As a result, all the data will be shown as a "Dashboard" to the top management of HEI, which will simply perceive information about the weaknesses and gaps for achieving certain objectives.

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Session

Policy Aspect

IMO Session in Classroom: A Case in Experiential Learning

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Keywords: maritime knowledge, IMO, peer experience, lifelong learning.

Abstract: Modern maritime training formats have been reflective of the cognitive and psychomotor domains of the core disciplines and the affective domain also gets a moderate attention. Student-centric curriculum designs have evolved based on domain taxonomies and action verbs defining the learning objectives. While the outcome-based learning approach is well suited for competency formats, a holistic approach would warrant a balanced treatment of all the three domains. This would imply that education and training have to extend to other related realms of the professional precincts. In effect, the aspirant has to be exposed not only to the core professional knowledge but also to the peripheral and related knowledge of the industry. Instructional design formats must have scope for the pursuant to learn about the industry's regulators and stakeholders as also on the functioning of its segments.

An extracurricular activity was undertaken by the University to disseminate the knowledge about International Maritime Organization. The treatment groups included undergraduate and postgraduate students. An experiential learning process, seen as being 'adaptive and purposed' rather than being a prescriptive hand-down education, was envisaged.

In this exercise, the functioning of the IMO's Committees was recognized as the related knowledge and a model was framed to impart this knowledge. The model involved role plays and mock action-theatre ambience. The processes for tabling, discussing and adopting resolutions were taken as the learning objectives for the act. Student groups drawn from the University's campuses were arrayed to play the roles of stakeholders (e.g., existing Member State as a developed/man power supplying/oil exporting country; Flag of Convenience etc.). External experts having experience in attending the actual IMO sessions were lined up as the mentors, which helped the students to construct their idea of the IMO and the topics to be tabled.

With definitions in place, several fora were organized where students presented ideas and solutions on chosen topics having relevance and contemporary value. Significantly, the presentations involved a high percentage of self-research by the students. Student Groups went through the 'mock sessions' under a competitive format. The most impressive student groups were brought up to a final confluence, while maintaining the 'twinned' nature of the functioning of the IMO's Committees. The complete implementation was done through online modes, while the groups which were present physically followed the social distancing norms etc. Industry personnel who had been attendees at the IMO sittings and similar fora were invited to witness and judge the presentations. The winning teams were awarded prizes and certificates. Apart from the takeaways of the IMO's working knowledge through 'experience from the experienced', the exercise saw welcome changes in language, presentation skills and public speaking proficiencies.

This paper presents the organic development of this experiential learning model. Based on the positive feedback from stakeholders and the students alike, the exercise will be expanded to include the affiliated Institutes (of the University) and other national Institutes. It is also proposed that this exercise could be extended to global regional levels where Maritime Education and Training Institutes of other Member States can participate. The winners can be rewarded with visits to the actual IMO sessions etc.

Analysis and Consideration of the Navigation Support Capability of Arctic Shipping Route of China

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Abstract: In order to have a more systematic understanding of China's navigation support capability of Arctic Shipping Route and to form a basic perception of the situation to inspire the subsequent work related to its development, this paper makes a targeted analysis and functional classification of China's navigation support in all aspects for Arctic Shipping Route at the present stage, and makes a comparison from the actual demand, so as to point out the shortcomings and explore the sustainable development.

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Identification of Features Associated with University Dropout-a case study of University of Split, Faculty of Maritime Studies

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Keywords: maritime higher education; dropout; machine learning; feature selection; Faculty of Maritime Studies Split

Abstract

The primary goal of higher education institutions is to provide a quality educational process. Graduation rates, dropouts, or length of study affect university rankings, faculty reputations, and financial aid. Maritime higher education is an essential element in acquiring the knowledge, understanding, and skills needed on board a ship. It has helped produce the quality of graduates that supply the maritime industry. One of the indicators of potential problems in this educational process may be a high number of dropouts in the early years. Predicting student success and dropout, or identifying students who are at higher risk for dropping out, is critical to improving the level of quality in the higher education system. In order to better understand dropout, an analysis of the academic performance of students at the University of Split, Faculty of Maritime Studies was conducted. The data are processed and the features that influence failure are extracted through an attribute selection algorithm and machine learning techniques such as decision trees. This research aims to improve early prediction of student dropout by identifying the most relevant features. A high dropout rate was found when tracking student performance at the Faculty of Maritime Studies at the University of Split. The results of our research indicate that higher education institutions should be aware of the need to determine the profile of students at potential risk of dropout at an early stage. Moreover, the developed model is useful for strategic planning of additional mechanisms to improve the efficiency of studies at maritime higher education institutions.

Identification and reduction of seafarers' cognitive and behavioral fatigue impacts for effective MET policy development

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Keywords: fatigue, research, cognitive, behavioral

Abstract: The analysis of the interviews, conducted among the crewing agencies representatives, active seafarers and cadets, and review of the instruments, developed by the International Maritime Organization, display fatigue as one of the leading factors greatly influencing the seafarers and effectiveness of their performance, especially due to the COVID-19 pandemic. Therefore, the aim of the proposed paper is to share the results of the implemented research, related to fatigue markers identification and proposal of fatigue impact decrease. Thus, the research is implemented, covering two major directions. The first part of the research deals with major cognitive and behavioral influence of fatigue upon seafarers. Hence, the research focuses on the fatigue impact upon cognitive performance of the seafarer, such as a significant decrease of decision-making capability, deprived memory and slackening of cognitive processes. Mood and attitude change are analyzed in the sense of behavioral effects of fatigues. The analysis also shows the direct relation between the fatigue and a set of dangerous changes in the seafarers' performance, such as inability to manage a series of activities, concentration only on a single task or a trivial problem in line with neglect of the vivid ones, application of clearly useless habits and lack of lookout. It shall be taken into consideration, that the seafarers, affected with fatigue are prone to avoid solution of the complex problems, which are characterized with the problems of multitasking. Especially hazardously fatigue affects upon a proper acquisition of distance, speed and time. Indecisiveness of fatigue affected seafarer gives rise to slow response to emergency situation and choose of a risky and unsafe option. Memory lapses lead to fail to remember the sequence of assignment or assignment components, events or procedures. Social involvement and participation are impeded due to a common irritation, decreased tolerance and anti-social behavior and depression of the seafarers. In our opinion, the most dangerous results of fatigue which greatly influence the seafarers' professional duties are related to failure to predict danger, unawareness of own low effectiveness, increased carelessness, low motivation and a "don't care" attitude.

Consequently, the second part of the paper presents the set of modern techniques, developed to reduce fatigue and its effects. In order to check the efficiency of the techniques, our research team provided the series of simulator-based modeling of fatigue decreasing methods.

Therefore, backed by the empiric results, the conclusive part of the paper offers inclusion of the modern techniques of fatigue detection and decrease into MET policy development. So, ability to detect and reduce fatigue, its signs and effects independently, shall greatly improve the seafarers' performance and safety.

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HELPING TO ACCELERATE THE GLOBAL MARITIME PROFESSIONAL BODY OF KNOLWEDGE UP THE S-CURVE OF INNOVATION

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Keywords: Global Maritime Professional, Innovation, Technology, Constructive Alignment, Outcomes

Abstract: In a visionary effort to help guide maritime education and training (MET) institutions in readying their students for an evolving future resulting from an information revolution, the International Association of Maritime Universities (IAMU) released the inaugural edition of Body of Knowledge for Global Maritime Professionals (GMP BoK) in 2019. The GMP BoK may be viewed as not simply as an assessment tool, but rather as a *technology*, where scientific knowledge is being applied for practical purposes – in this case, to improve the MET systems for developing global maritime professionals. Most technological innovations follow a predictable pattern of growth and adoption, commonly referred to as the S-curve of innovation. Like other technologies in their nascency, the GMP BoK lies at the bottom of the S-curve of innovation where growth and adoption are slow. The goal of most technological innovations is to climb the S-curve and realize exponential growth and adoption. However, additional effort and expense (such as through positioning and promotion of the GMP BoK) are unlikely alone to yield advancement up the S-curve of innovation. Instead, continuing improvements (or product enhancements) of the GMP BoK will be needed to enable significant growth and adoption. In the "living resource" spirit of the authors' vision of the GMP BoK, this paper will explore several potential ameliorations. Examples of GMP BoK improvements to be explored may include further attention to:

- Increased Accessibility: Leverage the open-source, high-flexibility model of the GMP BoK to maximize usage
- Simplicity/Complexity Balance: Enhance GMP BoK complexity for making data-driven decisions while retaining simplicity for the end-user in the interface
- Additional Customization: Increase flexibility to apply GMP BoK to allow customized focal areas / domain needs

Additionally, while the GMP BoK indicates learning outcomes for specific circumstances, there is a growing demand within the MET community to develop coherence among learning outcomes, learning activities (e.g. instructional methods), *and* learning assessment. Therefore, this paper will also examine frameworks of constructive alignment for outcomes-instruction and outcomes-assessment. Each of the elements of coherency might eventually form the impetus for establishing companion documents to the GMP BoK.

PROPOSING A VALIDATION TOOL FOR IMO MODEL COURSES TO EVALUATE ALIGNMENT OF OUTCOMES, ACTIVITIES, AND ASSESSMENT

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Keywords: Pedagogy, MET (Maritime Education and Training), STCW, Model Course, Outcomes Assessment

Abstract: Whether informed by backward design [1], constructive alignment [2], [3], outcomes-based education [4], or even essentials formulated decades earlier [5], there appears to be strong convergence that there should be coherence among learning objectives and/or outcomes, learning (or instructional) activities, and (learning) assessment. The maritime education and training (MET) community has widely adopted this coherence model and it is being implemented to various degrees. Recently, the International Maritime Organization has taken another step in developing its outcomes-based training policies by adopting verb taxonomies to develop learning outcome statements for model courses [6]. However, there is evidence that a number of IMO model courses lack alignment between their stated overarching aim and their learning domain coverage as a recent analysis of Model Course 1.20 (Fire Prevention and Firefighting) has shown [7]. Using the validation method developed by Cambridge Assessment [8], this study evaluates the alignment of domain coverage for IMO model course 1.21 (Personal Safety and Social Responsibility). Since the safety culture literature (e.g., [9]) and conservation literature (e.g., [10]) indicate that affect is an important determinant of pro-safety and pro-environmental behaviors, it was anticipated that this model course would have a substantial portion of affective domain coverage evidenced in its learning outcomes. However, it was found that this course has a preponderance of declarative knowledge and mental procedure outcomes and few affective, psycho-motor procedures, and interpersonal skills. Additionally, this study examined the coherence between learning outcome and instructional methods using existing frameworks (e.g., [11]) as well as coherence between learning outcomes and assessment methods using existing frameworks (e.g., [12]). The authors will make the case that a method for validating coherence among learning objectives and/or outcomes, learning (or instructional) activities, and (learning) assessment is needed in the MET community – as has been done in the IMO's sister organization IACO [13].

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Empowering teachers in Maritime Education and Training (MET) through gender-equality training: A bottom-up approach for the implementation of current legislation

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Keywords: Maritime Education and Training (MET), gender mainstreaming, bottom-up approach, gender equality strategy

Abstract: An increasing awareness of gender equality in the maritime sector is notable in recent years. While it is a good step forward, gender equality is often integrated into a diversity management agenda for leaders, but it is unclear how to apply the philosophy of gender equality in Maritime Education and Training (MET) led by teachers. This paper begins with a critical review of how the current focus on gender equality in the maritime sector tends to be limited and passive. A study by Barahona Fuentes et al. (2020) found that despite all the global and international legislation efforts, there was a scarce implementation of such policies in Maritime Education and Training (MET), which led to low numbers of female students in the vast majority of institutions. Another study by Böstrom and Österman (2015) also reveals a lack of clear strategies on behalf of MET institutions for these matters resulting in an inefficiency to address and improve gender equality. Further, the revealing IAMU project concerning gender equality in MET acknowledges the important role of MET institutions to increase gender and cultural awareness in their curriculum and instruction (Dragomir et al., 2018). Although there is a lot of literature on the difficulties and obstacles that deter the attraction and retention of women in the maritime sector (Kitada, 2021; MacNeil & Ghosh, 2017, Mackenzie, 2015), much less is known about how to bring about an effective change in the maritime sector, starting with MET institutions, which constitute the source of supply of future maritime professionals. It is evident that top-down approaches for the implementation of gender policies are often insufficient to achieve gender equality because they may fail to provide tools for an effective application and to recognize and consider the autonomy of practitioners who can actively contribute to gender equality with their work in different useful manners. The paper argues that bottom-up approaches can become an efficient method for the incorporation of gender mainstreaming by increasing the participation of practitioners and actively involving them in transforming their attitudes, practices and work methods. In fact, a balance between top-down and bottom-up approaches seems a desirable option as it combines the efficiency and leadership of the top-down approach with the collaborative advantages that come from the whole team. There are several examples of bottom-up approaches which were found to be successful in the maritime sector, such as multinational crew's onboard communication (Sampson and Zhao, 2003), maritime innovation training (Bolmsten and Kitada, 2020), International Maritime Organization's (IMO) Women in Maritime Associations (IMO, 2021), and the International Labour Organization (ILO)'s Participatory Gender Audit methodology is used to carry out the monitoring and evaluation of gender equality action plans at IMO. All these examples employ a common bottom-up strategy to empower practitioners for the culture of sustainable shipping. In line with this, an innovation teaching project is being developed at Barcelona

School of Nautical Studies (FNB-UPC) to implement another bottom-up approach for the incorporation of gender mainstreaming in their curricula. This project aims at training practitioners with good practices so that they can design tailor-made activities and develop strategies to transform their teaching. All these examples show that bottom-up approaches can be an effective method of empowering lower levels of the organizational hierarchy while giving them a voice to make small-scale decisions and assuming individual responsibilities, which may then be integrated into the higher-level framework of global goals. The paper further discusses the opportunities for MET institutions to encourage and empower MET teachers with respect to the incorporation of gender mainstreaming. This way, they will not become mere passive receptors of decisions made by higher levels in the organizational hierarchy but active and transforming actors in their routine of work. Finally, the paper addresses the role of the IAMU community to work together for gender equality in the context of MET.

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The role of simulator and co-teaching for developing student's thinking and speaking interactive skills

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Keywords: co-teaching, simulators, skills, competence

Abstract

The introductive part of the paper presents a review dealing with the importance of Maritime English competence for future seafarers and the challenges facing Maritime English teaching non-native English students. The study is mainly focused on the language teaching strategy for developing students' maritime English thinking and speaking skills with the help of simulator class realistic environment under co-teacher's support.

The second part of the paper introduces the importance of simulator training and co-teaching methods for the provision of effective conventionally required competence.

Thus, the third part of the paper offers the model of the simulator-based lesson developed in the co-teaching method. The frame of the model lesson is represented in 7 stages:

Stage one: The Bridge Recourse Management simulator class instructor prepares the scenario/ the exercise for class. English language teacher prepares the brainstorming activities over the topic.

Stage two: The lesson starts with brainstorming.

Stage three: Class briefing before the task performance, role sharing.

Stage four: Introducing the scenario.

Stage five: Task execution.

Stage six: Backed on the results of the lesson monitoring, teachers' assessment.

Stage seven: Debriefing, discussion advantages and disadvantages of the performed job.

The conclusive part of the article highlights the advantages of the simulator class teaching atmosphere, which will positively affect students' higher-order thinking and speaking skills. A wide range of tasks, performed by the student on simulators enhances student independence, simulator-based classes let students use all their skills: higher-order thinking and speaking skills, in the complex.

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A Comparative Study of Ship Risk Profile According to Port State Control Regime: A Case Study of Turkish Straits

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Keywords: Maritime safety, Narrow waterways, Ship Risk Profile, Port State Control, Turkish Straits

Abstract: The implementation and supervision of international regulations are crucial to ensure safety at sea. Port State Control (PSC) regimes have a great contribution to this by inspecting the safety standards and compliance with international regulations of ships arriving at ports in support of Flag State Controls (FSC) [1]. In PSCs, due to a lack of personnel for inspection and an excess number of ships to be inspected, risky ships are selected by ship risk profile and inspected, and substandard ships are detected [2]. Since the historical data of these inspections are evaluated, it is revealed that there are significant improvements in the establishment of life, property and environmental safety [3]. PSC is the last safety step, which is generally accepted as a measure to consolidate the old maritime safety net created by FSCs and classification societies [4]. In this study, Sailing Plan (SP)-1 reports data between the years 2005 and 2021, which are reported by ships passing through the Turkish Straits, and the accidents data occurred in Straits between the years 2004 and 2021 were obtained from the Turkish Directorate General of Coastal Safety. Besides, Paris MoU detention data and Black Sea MoU detention data were extracted from the website of the relevant MoU. After the data acquisition, detention data along with nonconformities of PSC were combined with ships' data passing through the Turkish Straits to compare the PSC Regime effect on the navigation safety of a narrow channel passage. Furthermore, exploratory analysis has been provided in order to reveal the maritime traffic structure of the Turkish Straits regarding PSC measures. The results have offered promising evidence of PSC implication on the navigation safety of narrow channels deemed as critical among other water regions.

Table 1. Ship data passing through the Turkish Straits between years 2005-2021.

	Count	Mean	Std	Min	25%	50%	75%	Max
Length	118520	157.51	57.06	34.84	108.50	152.50	189.99	399.99
Gross Tonnage	118520	20667.79	22573.83	142.00	3958.00	12449.00	29762.00	232618.00
Age during Passage	118520	16.18	11.62	0.00	6.00	14.00	25.00	60.00
Pilot onboard	118520	0.73	0.44	0.00	0.00	1.00	1.00	1.00
Draft	118520	6.95	2.73	3.01	4.90	6.50	8.40	19.28
Flag Factor	118520	-0.36	1.57	-2.00	-1.42	-0.88	0.00	10.60
Deficiency Number	118520	2.67	9.66	0.00	0.00	0.00	0.00	188.00
Detention Number	118520	0.36	1.04	0.00	0.00	0.00	0.00	20.00

Table 2. Ship accident data in the Turkish Straits between years 2004-2021.

	Count	Mean	Std	Min	25%	50%	75%	Max
Length	719	119.55	46.41	30.80	84.38	113.350	143.08	299.94
Gross Tonnage	719	8659.24	12945.10	148.00	1995.00	3712.000	9912.00	104729.00
Age during Passage	719	26.55	11.38	1.00	20.00	28.000	34.00	75.00
Pilot onboard	719	0.04	0.19	0.00	0.00	0.000	0.00	1.00
Draft	574	5.73	2.71	1.80	3.70	5.025	7.20	18.42
Flag Factor	699	0.98	2.16	-1.78	-0.55	0.440	2.27	12.68
Deficiency Number	719	4.10	11.56	0.00	0.00	0.000	3.00	146.00
Detention Number	719	0.64	1.29	0.00	0.00	0.000	1.00	11.00

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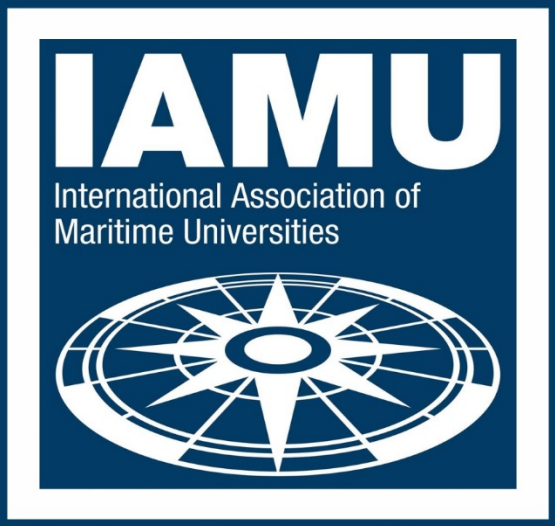
Acknowledgements

The article is produced from the Ph.D. thesis research of Cengiz Vefa Ekici entitled “Developing Ship Risk Profile Model for Turkish Straits” which has been executed in a Ph.D. Program in Maritime Transportation Engineering of Istanbul Technical University Graduate School.



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